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Science News x

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WINGS FOR THE SPIRIT[1]

The dedication to-day of facilities for the prosecution of laboratory and research work of the Mount Sinai Hospital has far greater significance than the addition of a unit to the institution. The achievements of this great hospital are well known to its patients and to their friends. The medical profession is familiar with the professional skill of your staff of physicians and nurses and the high efficiency of your administrators. Adequately supporting these, stands a Board of Trustees, noted for philanthropy, loyal to and sympathetic with the ideals of a modern hospital. The example you have so generously set will serve as a stimulus to other hospitals not as yet so fully equipped. The new facilities mean an increased effectiveness in the care of patients. The influence of your staff, improving their work with the facilities now offered, will be felt by the entire profession. The nation will more and more perceptibly become awakened to the conception that hospitals must move forward with the newer knowledge available to medical science. Contributions to prevention, diagnosis and cure of disease, inspired by the conveniences now offered in these walls, will be of lasting benefit to generations yet unborn. In discussing with you the achievement which your generosity has brought to fruition, I hope to make clear to you some of the matters, spiritual and material, which you may expect to result from your benefaction.

The fact that the practice of medicine in a well-conducted hospital requires a laboratory for aid in diagnosis and treatment is not generally realized by those who have the responsibility for providing funds. It is but too well known that numerous hospitals are designed without adequate laboratory space and equipment; and, even in those so provided, it is not uncommon to find insufficient appropriation for personnel and maintenance. For our own benefit, and perhaps for a more far reaching purpose, it may be well to support the implication which opens this paragraph. The primary objective of the laboratory is to aid in diagnosis, which is fundamental to proper treatment. The laboratory may even take its part in the treatment, through consultation with surgeons and by the preparation of such things as vac-

[1] Address at the dedication of the Laboratory of Pathology, Mount Sinai Hospital, Cleveland, Ohio, November 8, 1927.

cines and serums. The laboratory is also, in a sense, the guardian of the health of the hospital. Its workers detect the presence of infectious diseases in patients and hospital personnel and may guide the authorities in preventing the development of an epidemic. The efficacy of sterilization of materials used in the surgery may be determined, and services may be equally useful in other similar matters.

The work includes diagnosis of tumors and other surgical diseases, the selection of donors for blood transfusion, the identification of bacteria and other parasites, as for example of tuberculosis meningitis, pneumonia and malaria, the chemical examination of the blood in order to aid in distinguishing between several otherwise confusing diseases, the performance of such tests as the Widal test for typhoid fever and the Wassermann test for syphilis, and numerous other procedures. Without an accurate diagnosis, treatment is entirely empirical, may be worthless and might be dangerous. The laboratory, then, is concerned largely with aid in the diagnosis of disease. It is to be noted that the laboratory rarely makes the diagnosis, for there are few diseases in which the laboratory has a test which is absolutely and finally conclusive.

A matter deserving the frankest discussion is the autopsy. The Jew is considered to be the most reluctant to permit autopsy of all those who constitute Occidental civilization. Much attention has been given the religious aspects of this question. It is said that the rabbis of the Talmud consented to the autopsy if it honored the dead or if it gave information of immediate value to someone suffering with the same disease as the deceased. The autopsy was to be forbidden if it desecrated the dead or if the benefit were to be of only general rather than immediately applicable value. The far reaching significance of science of all kinds was not appreciated at that time. Men know now what science has done for them and the prospects it has in store. The autopsy is the basis of much that we have learned about disease and will continue to contribute to our progress. Religion is not static but shows evolution. Modern opinion in the church is generally to the effect that the value of the autopsy to the relatives, to the community and to medicine outweighs regulations that were made at other times and under other circumstances. Rabbi J. B. Levinthal, of Philadelphia, is quoted as saying that the postmortem examination is not forbidden by the Jewish Rabbinical Law, and further, that "where a postmortem examination may result in the discovery of the origin or cause of some serious disease, it is my firm conviction that thus to serve humanity is sanctifying, rather than desecrating, the dead." Any autopsy may serve this purpose and no one can say in advance what the results will be. Hospital administrators and officers are generally of the opinion that "the history of a hospital fatality is not complete unless the (autopsy) report of the pathologist is included," and what applies to hospital patients applies equally to those who may die at home. We must demand of our pathologists that the dead body be regarded as the material remains of a loved soul and that they treat it accordingly. Only with rare exception is such a caution necessary. In spite of all sentiment and even superstition, the autopsy may well be regarded as an honor to the dead and is certainly a service to mankind. "When a patient dies a great debt is owed humanity in order that the patient shall not have died in vain."

The time is not so long past when the physician considered it beneath his dignity to touch the patient and employed a barber to perform the surgical operations. Physical diagnosis, including palpation, percussion and auscultation, is little more than a century old. We have then only recently emerged into a period, where, in addition to taking a history and making an inspection, the physician actually handles his patient to discover what is wrong. Once having taken the step, the physician was whole hearted about it, and in the middle of the last century the physician was tasting certain body fluids to detect diabetes and the pathologist tasting cerebro-spinal fluid in order to give an accurate description. Now the physician uses a thermometer to determine temperature instead of feeling for it, he uses a sphygmomanometer to determine blood and pulse pressure instead of depending upon his sense of touch, he uses an electrocardiograph to study cardiac irregularity instead of guessing at the cause, he examines materials by chemical tests instead of by taste, and in a wide variety of ways has improved his methods. He has not only enlarged his field of examination but continuously has developed increasing technical precision. In brief, he uses every means available to determine the nature of his patient's disease.

The young men now in our medical schools, the physicians of the future, are trained in the methods of the clinic and the laboratory and learn to evaluate the results of each. They wish to know what causes the disease, to eliminate it if possible, what organ or organs exhibit disease and how the functions are disturbed, to correct them if possible. The problem has become so intricate that no one man can master all its ramifications. Hence, specialties have developed and a group of men has grown up who have a particular interest in the laboratory side of medicine. These men are of a special mould, foregoing the glamour of practice and its rewards, because of a peculiar interest in the scientific aspects of laboratory

work. They must have training and a proper equipment for work. The fact that in the past good work has been done and important discoveries made under adverse physical conditions should not divert us from the provision of better things. The world moves and the high speed of civilized life in general is reflected in the laboratory. If the commercial plant has labor saving devices, so should the laboratory. If the factory has special provision for light and ventilation, so should the laboratory. If the shop has precise instruments, so should the laboratory. The pathologist deals with affairs immediately concerned with human life and suffering. His is no eight-hour day. The import of his work is beyond question and he should be provided with equipment so that it may be conducted with convenience, speed and precision.

These notations have dealt with material conceptions, but only as the basis for the soaring of the spirit. This spirit is the series of motives which actuate medicine. First there comes to mind the spirit of service. This is the great humanitarian spirit of the votaries of medicine, but is shared in greater or less part by all professional and business activities engaged productively for the welfare of man. Ancillary is the spirit of sacrifice which in its highest form is vicarious. Typified in its extreme on the Cross of Calvary, it is found on the battlefield, in industry, in business and the professions. Medicine points with pride and humility to its list of heroes who have given their health and lives for the promotion of knowledge. Then there is the spirit of truth, truth for its own sake, truth without reward other than the supreme joy which its discovery gives. All problems put before us are no more than amplifications of the question, what is the truth?

The spirit of service and of vicarious sacrifice is inherent in the forward urge of mankind. It transcends the flesh. So also is the nature of the spirit of truth. The truth itself, however, requires constant search. Blessed are those who can provide wings for the search and even more so are those who can don them creditably. It is your privilege to provide the wings here, building, equipment, personnel, funds, and it is for us to show you the way of the flight.

Truth as we find it is not absolute, and may not be the same to-morrow as it was yesterday or is to-day. Truth is revealed by the demonstration of facts, which represent observations dependent upon methods. Human imagination and ingenuity evolve new and improved methods and, as circumstances alter, truth may alter with them. In the fifth century before Christ, Protagoras said, "Man is the measure of all things" and taught "that there is no absolute truth, that we know things only as they appear to us through the senses." Thus rational thinking through the ages has drawn attention to philosophical relativity, and we must face the fact whether dealing in pure reason or in material science.

This discussion is preparatory to a consideration of the truth as revealed in the laboratory. Without such a background misconceptions may arise in thinking our wings to be more sturdy than they are. When we say that the laboratory deals with facts, we mean that by methods of delicacy and precision which meet the rules of scientific procedure, a conclusion can be reached that, within the limitations of the methods available, the truth has been demonstrated. A truism of science is to the effect that it is wasteful to deal in the fourth decimal when the third decimal will provide the necessary information. The third decimal is not necessarily exact in such an instance, but for scientific purposes it represents the truth. When the laboratory furnishes a report, it must be regarded as exact within the factors of error inherent in human nature and in the methods of study available. Increasing precision of instruments and methods tends to obviate the fallibility of our unaided senses. Quoting a recent article of Peabody, "the popular conception of a scientist as a man who works in a laboratory and uses instruments of precision is as inaccurate as it is superficial, for a scientist is known not by his technical processes but by his intellectual processes; and the essence of the scientific method of thought is that it proceeds in an orderly manner toward the establishment of a truth."

As concerns the patient, the truth of a given situation may be provided by the laboratory, but the truth of the whole picture is made up of the results of laboratory and clinic correlated by orderly processes of thought. The methods of the laboratory are those of a high degree of exactitude and the material is in such form as to permit of direct study. This and this only gives the laboratory a distinct advantage over the clinic, and it is for this reason that the modern clinician asks the aid of his laboratory colleague. Many clinical examinations are of necessity by indirect methods, and the further information yielded by laboratory tests is often of inestimable value to the welfare of the patient. A noted hospital administrator, not a pathologist, Bluestone, has said that "broadly speaking no hospital is larger than its pathological laboratory," and that "the progressiveness of a hospital is in direct ratio to the laboratory spirit which it maintains." Permit me to point out that the maintenance of this spirit, springing primarily in the professional staff, must, in order to be effective, have not merely the assent of administration and trustees, but their cordial and enthusiastic sympathy and support.

You have provided not only a laboratory, but also

a center for research in the medical sciences. The activities of skilled physicians differ according to training, aptitude and opportunity. He who is a practitioner applies the knowledge of the day to the care of the patients of the present. He who teaches trains a group of students for the care of patients of the near future. He who investigates disease deals not merely in matters of the present, but rather of the future near and remote. Examples of how discoveries may reach far into the future are numerous, but a few will suffice. The discovery of the circulation of the blood by William Harvey has enlightened the world for centuries. The discovery of immune processes by Louis Pasteur has been of inestimable value long after his death and will be so permanently. The discovery of the insect transmission of disease brought forth amazing fruit within the lifetime of its discoverer. The discoverers of insulin are still young men.

Pasteur said that "in the fields of observation, chance favors only the mind that is prepared," a statement that might serve to clarify for you some of the features of investigative work that may have been puzzling. In the first place great discoveries often seem to come out of a clear sky, but this is not literally true. The investigations have been conducted by trained persons with the "prepared mind." Behind them is a background of experience personal to them and to others as recorded in the literature. The prepared mind is prepared partly by a reasonable familiarity with the work of others through conference, attendance on scientific meetings and access to the literature, and principally by experience in the methods of science and productive original work. When the "readiness is all," an isolated observation may open a field of vision for one who is prepared and may mean nothing for one who is not. An amazing example of this is given by the great physiologist Claude Bernard in his book, recently translated, "An Introduction to the Study of Experimental Medicine." The urine of well fed rabbits is usually cloudy and alkaline. Bernard, by chance, noticed that the urine of rabbits which had just been purchased for his laboratory was clear and acid, and found that they had not been fed for several days. By a series of experiments and further observations, this occurrence became the background for the discovery of pancreatic digestion, not only of singular novelty and significance to physiology but applied daily in the clinics of to-day. Kanavel wisely says "great knowledge acquired from reading and not from actual experimentation engenders a benumbing subservience to the written word." The worker has ever an opportunity to which the reader has no access. Nevertheless, the worker is in a superior position to profit by observations if he knows what has gone before.

In the history of science, it would seem that the world must be prepared for discoveries before their exploitation is possible. The receptiveness for new announcements seems to depend upon general world progress, contributed to in various domains of art and science, to the observation of facts that in themselves seem to be of little significance and to discoveries of outstanding importance. The use of the term exploitation is with all scientific reserve, but its importance to the common welfare should not be underestimated. The fact that the work of Mendel, which underlies the modern work on genetics and heredity, had to be rediscovered, was largely due to the fact that at the time it was not exploited. In your provision for research in this fine building, you have not completed the task until you make provision for the suitable publication of the results, and the workers in the laboratory have not fulfilled their trust until reports have been made in channels of publication where they will be most useful.

These implications are preliminary to a brief discussion of the costs of scientific research. All financial investments have an element of uncertainty. The most secure usually have the smallest rate of return. Generally speaking, this applies to research. There is this important difference, however, in that the research investments of apparently small return may, by accumulation or by chance observation, form the basis for a research investment of large return. A study, which from its inception is certain to give a useful result, positive or negative, may furnish what might be called one of the fragments of a puzzle picture. When a sufficient number of fragments is accumulated, a creative imagination, piecing them together, may see the way to providing the final fragment which will clarify the composite whole. The most recent example is the discovery of insulin. Studies of the changes of sugars within the body have been conducted for many years and formed small fragments of the complete picture. A large fragment was provided by von Mering and Minkowski in the discovery of the relation of the pancreas to the metabolism of sugar. Another larger fragment was contributed by Opie in relating changes in the human pancreas to diabetes. The vision and work of Macleod, Banting, Best and Collip, based on this background, furnished the final and immediately practical fragment which made the picture whole. Further studies along this line are directed toward filling in certain details of importance and rendering the practical features more satisfactory.

As with investments, the speculative factor must be considered. No wise investor indulges his gambling instinct in projects which examination shows are without the slightest guarantee of return. So the scientific investigator should not consume time and energy in

studies which to the experienced student are without promise. There are, however, speculative investments where the promise of large return is as great as the promise of a total loss. The investigator frequently finds himself facing a position of this sort. It is for him to say whether or not he will chance his time and energy on the study and if he decide affirmatively, those who give him financial support should back him without stint, for he has more to lose than mere money and what he gains is for the benefit of mankind.

You repeatedly entrust your health and lives to the judgment of the physicians and surgeons of this fine hospital. There should be no hesitation in entrusting the funds which you give to it, in expanding amounts, to the judgment of those who give their lives and energy to the research work within its walls. A great philosopher, René Descartes, said many years ago that "if ever the human race is raised to its highest practical level, intellectually, morally and physically, the science of medicine will perform that service."

The designer of the aeroplane gives little to humanity if his machine is to remain without fuel and there would be no practical benefit without the adventurous spirit which through pioneering in unexplored fields leads on to progress and to newer and broader visions. The plane is built, the laboratory completed. All honor to the designers and builders. The fuel is not merely the material means of operation, but it must volatilize as faith in the pilot and his crew, faith in their productive capacity, faith in their guiding genius. The pilot has many mechanisms to oversee. These should be as nearly perfect as the mind and hand of man can devise, so that the spirit shall not be hampered. The pilot is the directing intellect of the flight. Give freedom to his imagination and energy. The time will come when his wings are no longer rigid and he can fly freely in the skies of truth toward his ultimate objective, the welfare of man.

My congratulations to the trustees, the director and the staff of Mount Sinai Hospital. May they live long and may their work prosper.

HOWARD T. KARSNER
WESTERN RESERVE UNIVERSITY

COMMEMORATION OF THE BI-CENTENARY OF THE DEATH OF NEWTON[1]

THE fourth annual meeting of The History of Science Society was held in pursuance of an act of its council of last year, to commemorate the bi-centenary of the death of Sir Isaac Newton. In view of this unusual occasion, and of the manifold interests Newton had, it was therefore considered expedient to ask those societies most interested to cooperate by appointing representatives on the committee preparing the program. The following names are those who served:

COMMITTEE ON PROGRAM

Dr. R. C. Archibald, Brown University Dr. E. W. Brown, Yale University Dr. Florian Cajori, University of California	The American Mathematical Society and The Mathematical Association of America
Dr. A. O. Leuschner, University of California Dr. Frederick H. Seares, Mount Wilson Observatory	The American Astronomical Society
Dr. Leigh Page, Yale University	The American Physical Society
Dr. David Eugene Smith, Columbia University, Chairman Dr. Henry Crew, Northwestern University	The History of Science Society
Mr. Frederick E. Brasch, Library of Congress	Secretary to the Committee

The meeting was called to order by the president of The History of Science Society, Dr. David Eugene Smith, at 10 o'clock A. M., Friday, November 25, 1927, in the Educational Hall of the American Museum of Natural History, New York City.

The two days' program consisted entirely of papers on various phases of Sir Isaac Newton's contributions to astronomy, mathematics, physics, chemistry, religion, problems of the mint, and the development of science since his day, also some indication of Newton's influence on the early science in the American Colonies from 1687 to 1779. Two papers were devoted to each subject and these were given by scholars of distinction—from both the United States and Canada. Twelve papers reviewing Newton's work from the present historical standpoint made what is probably one of the most notable of single contributions to scientific literature. These addresses are to be published (by the History of Science Society) in a memorial volume.

The object of this American commemoration was twofold, first to honor the great name of Newton, and

[1] Report of the meeting and exhibition under the auspices of the History of Science Society, held at the American Museum of Natural History, New York, November 25 and 26, 1927.

second to acquaint the younger generation of students, as well as the public at large, with the contributions made in the various fields of knowledge in which Newton labored. From the standpoint of interest and attendance, the meeting was successful.

Old England may justly feel proud of the recognition America (United States) has accorded her greatest philosopher. Similar celebrations have taken place. Particularly we note the program given in Grantham, Newton's birthplace, on Saturday, March 20, 1927, the exact date of the bi-centenary of his death, which was attended by many of the greatest scholars of the British Empire, as well as by representatives from abroad. Both commemorations will go down in history and furnish most interesting recapitulations of Newton's influence in the history of science and civilization.

Following the abstracts of papers presented, a brief account of the exhibition is given. Dr. David Eugene Smith, chairman of the first morning's program, gave the introductory address. He spoke of the occasion of the Commemoration and of the life of Sir Isaac Newton. He said in part:

We come here to-day for two major purposes: First, to pay our respects to the memory of a man who is rated by the world as one of its greatest geniuses; and second, to weigh once more, by modern criticism if not by scales of precision, the world's claim that its judgment is just.

Of the esteem in which Newton's work has been held for two centuries there is no question. Few men have ever fared so well. The justness of that esteem has, however, been seriously questioned by various scholars of reputation. There have been assertions that his word was not "as good as his bond"; that his influence upon British mathematics was not salutary; that he abandoned the altar of science for the fleshpots of Egypt; that the foundations of his greatest mathematical theory were weak and the theory was unstable; and that he stands as a fetich for the unthinking worship of the Anglo-Saxon. Nor have there been lacking expressions to the effect that, had he been the great genius that England asserts, his countrymen would long since have given to the public a definitive edition of his complete works, his correspondence, and his papers. Such editions are a common tribute paid by nations or societies to the memory of their great men. Why should England have published the monumental editions of Cayley's and Sylvester's works and yet have so neglected Newton and have allowed the Portsmouth papers to lie practically in oblivion? Was there not back of all the praise, a feeling that the nation had risen to his defense in an inglorious dispute, but that at heart it doubted his greatness?

These questions have not been raised merely by men of no intellectual capacity who seek a place in the limelight by decrying the work of others; by those who, as a French philosopher has put it, rail at greatness because they can not achieve it. They come from honest-minded men who really wish to know what it was that Newton accomplished to make him worthy of the acclaim that has been accorded him; who ask for an answer, without excess of praise, to the justifiable question, "What were Newton's real contributions to world knowledge?" To give and to receive this answer is one of the purposes of our meeting. The answer, however, can not be given with authority by any one man or by any small group of workers in a single field; it can come only from several men, representing the various major fields in which Newton showed an interest. It is with this thought in mind that representatives from different learned societies have been requested to place before other scholars a series of succinct but authoritative statements of his achievements.

When we review his life, his idiosyncrasies, his periods of contrast, and his doubts and ambitions and desire for place, may we not take some pleasure in thinking of him as a man—a man like most other men save in one particular—he had genius—a greater touch of divinity than comes to the rest of us?

The questions to be answered by the speakers will relate chiefly to Newton as a scholar, and upon the answers will depend our judgment of the justice of the praise that has been given him. One thing will not fail to stand out clearly, however, that few men have ever lived who explored so successfully as wide a range of human activities, and few who could so justly have used the well-known phrase,

Homo sum, et nihil humani a me alienum puto.

The second address was by Dr. Dayton C. Miller, of the Case School of Applied Science, who spoke on "Newton and Optics."

This convocation is held to commemorate the bicentenary of the death of Sir Isaac Newton which occurred in London on March 20, 1727. We are not now just discovering Newton's greatness; in his own life time he was regarded as the greatest man in intellectual achievement which the world had known; the greatest possible posthumous honors were done him. . . . Voltaire, a contemporary, said of Newton: "If all the geniuses of the universe were assembled, he should lead the band." The appreciation of his greatness has continually increased during the two centuries that have elapsed since his death. . . .

In the year 1668, Newton made the first reflecting telescope, but he had not yet discovered the nature of the spectrum, for in 1669 he helped Dr. Barrow in

the publication of Barrow's lectures on optics, in which an erroneous theory of color is set forth. . . .

In the autumn of 1671, Newton made a second reflecting telescope and the fame of his researches, especially in optics, began to spread. He was proposed as a candidate for admission to the Royal Society in December, 1671, and was asked to send the reflecting telescope to the society for inspection. The instrument was sent to London, and was exhibited before the Society on January 11, 1672, at which time a description of the telescope was read, and Newton was elected a fellow of the society. This telescope has ever since remained with the society as one of its most cherished possessions. Newton was very much pleased with the honor of election to the Royal Society, and his acknowledgment to the secretary, sent one week later, says:

> I desire that in your next letter you will inform me for what time the society continue their weekly meetings; because, if they continue them for any time, I am purposing them to be considered of and examined on account of a philosophical discovery, which induced me to the making of the said telescope, and which I doubt not but will prove much more grateful than the communication of that instrument, being in my judgment the oddest if not the most considerable detection which hath hitherto been made into the operations of nature.

This promise was fulfilled by a communication which was read just one month later and the "considerable detection into the operations of nature" proved to be the complete explanation of the nature of the solar spectrum, and the true theory of color. . . .

Nothing more was done in the domain of optics, until, in 1704, Newton published the first edition of his book called "Optics; or a Treatise of the Reflections, Refractions, Inflections and Colours of Light." There were slight additions made in the second edition which appeared in 1718. For our present purpose, it seems desirable to give a description of the contents of this book, which covers all of Newton's work in optics, and to make a kind of inventory of the optical developments due directly to his work, as interpreted in the light of the third century following their origin. . . .

> Rays of Light, by impinging on any refracting or reflecting Surface, excite vibrations in the refracting or reflecting Medium or Substance, and by exciting them agitate the solid parts of the refracting or reflecting Body, and by agitating them cause the Body to grow warm or hot; that the vibrations thus excited are propagated in the refracting or reflecting Medium or Substance, much after the manner that vibrations are propagated in the Air for causing Sound, and move faster than the Rays so as to overtake them; and that when any Ray is in that part of the vibration which conspires with its Motion, it easily breaks through a refracting Surface, but when it is in the contrary part of the vibration which impedes its motion, it is easily reflected; and, by consequence, that every Ray is successively disposed to be easily reflected, or easily transmitted, by every vibration which overtakes it. But whether this Hypothesis be true or false I do not here consider.
>
> The returns of the disposition of any Ray to be reflected I will call its Fits of easy Reflexion, and those of its disposition to be transmitted its Fits of easy Transmission, and the space it passes between every return and the next return, the Internal of its Fits. (p. 256.) . . .

It has been very generally stated that Newton adopted and developed the corpuscular theory of light, in which light consists of small particles and nothing else. This interpretation was really thrust upon him by his successors, for he was always exceedingly careful not to commit himself to any specific theory of the structure of light. Thirty years before his treatise appeared, when he was actively engaged in the optical researches, and was sending reports to the Royal Society, he wrote to Hooke, saying: "Were I to propound an hypothesis it should be this, that light is something capable of exciting vibrations in the ether." Again he says: "The hypothesis of light being a body, had I propounded it, had a much greater affinity with the objector's own hypothesis (Hooke's Undulatory Theory) than he is aware of, the vibrations of the ether being as useful and necessary in this as in his." . . .

The science of light to-day is indebted to Newton not alone for his discoveries in optics, but in a greater degree to his general influence upon the methods of philosophic thought. The discovery of universal gravitation is the discovery of the law of universal order, which is the basis and essential character of all science. The example of such profound and comprehensive philosophizing has been one of Newton's contributions to optics as well as to other sciences.

And now, two hundred years after the death of Newton, we in behalf of the science of optics, wish to join the great chorus of all the sciences in doing reverence to him, not for what he was, but for what he has been for these centuries, and for what he is now. We repeat the inscription on the Westminster Tablet which was erected in 1731:

> LET MEN REJOICE
> THAT SO GREAT A GLORY OF THE HUMAN RACE
> HAS APPEARED

The third address was on Newton's Philosophy of Gravitation with special reference to Modern Relativity Ideas, by Dr. G. D. Birkhoff, of Harvard University.

Up to the time of the ancient Greeks, scientifically-minded men had accumulated comparatively few experimental facts. For the description of these facts ordinary geometrical space and measurable time, which seemed self-evident, were available. Copernicus took the space attached to the sun to be at rest. On this basis Kepler deduced his three laws of planetary motion and was led to correct ideas about the forces of gravitation. Newton's greatest achievement lay in overcoming many mathematical difficulties and establishing the laws of gravitation and of motion known by his name. It was stated that Newton's scientific procedure was according to the best general principles. The reason for the recent progress to the relativistic theory of gravitation was found in the accumulation of evidence that the physical universe is basically electro-magnetic, rather than dynamical. Nevertheless the Newtonian dynamical theory of space, time and gravitation will always stand, as the first and simplest approximation to the facts.

The final paper on the morning program was by Dr. W. W. Campbell, president of the University of California, upon "Newton's Influence upon the Development of Astrophysics."

Astrophysics is concerned with what the stars, comets, nebulae and other celestial bodies really are, and why they are as they are. Spectrum analysis, the most remarkable, the most fruitful system of analysis in existence, rests upon Sir Isaac Newton's discovery that white light—sunlight, starlight—contains light of all known pure colors—really an infinite variety of colors. When starlight is passed through a telescope and a spectrograph attached thereto, the light records a message on the photographic plate—the star's spectrum—which describes precisely the conditions prevailing in that star. The finding of spectroscopic Rosetta stones, by Kirchhoff in 1859, and by his many successors in our physical laboratories, is enabling us to read the messages which many thousands of stars have sent to us and written down for us. These messages tell us what chemical elements and compounds, in the form of vapors and gases, are present in the outer strata of the stars, in comets, in the many kinds of nebulae. They tell us that our chemical elements are widely—perhaps universally—distributed throughout the universe. They tell us whether a given star is approaching us or receding from us and with what speed; that a certain star is a giant or a dwarf star and how far away it is; and a seemingly endless procession of facts relating to the conditions existing in the stars and other heavenly bodies.

The law of gravitation, discovered by Newton, is enabling us to learn much concerning conditions in the interiors of the stars, the comets and other objects.

Sir Isaac, with his own hands, constructed and used the first reflecting telescope, the forerunner of the giant reflecting telescopes of to-day.

Newton developed a preference for the corpuscular theory of light, as opposed to the undulatory or wave theory. To this end he may have been influenced by the difficulty of understanding why light radiations escaped paying toll for their transmission through space by wave motion. In the last year or two many physicists—notably de Broglie, Schroedinger and others—appear to be advocating a combination of the corpuscular and undulatory theories of light, as Newton himself very definitely did. Astrophysicists will be tremendously interested to learn the real nature of light, so that they may apply its principles to the solution of many of their most difficult problems, such as those of stellar evolution.

Sir Isaac Newton was uniquely the great pioneer in astrophysics.

Dr. E. W. Brown, of Yale University, presided at the afternoon program and introduced Dr. M. I. Pupin, of Columbia University, as the first speaker, whose remarks were upon "Newton's Dynamics."

The bi-centennial commemoration of Newton's death turns our thoughts to his great achievements, and the greatest of them is his science of dynamics. This achievement is the crown of the scientific endeavors of the two centuries which preceded Newton.

The most precious part of the Copernicus, Brahe and Kepler triumph was the great dynamical problem which was suggested, and which can be stated in the form of the question: Why do the planets move in accordance with Kepler's laws? This question was a hopeless puzzle to the science of the sixteenth century.

The problems of pendulum motions and of the motions of projectiles yielded to Galileo, but his dynamical science could not answer the question: Why do the planets move in accordance with Kepler's laws? Neither could the dynamical science of Galileo's successors who preceded Newton answer it.

The momentum concept was created by Newton, and it is the most fundamental concept in his dynamics. His second law of motion expresses this fundamental character of the momentum concept by making its time rate of variation equal to the moving force. This measure of the acting and reacting forces not only conformed with the results of Galileo's experiments but, moreover, it shed new light upon them which was not visible to Galileo nor to any of Newton's predecessors. It also agreed with all impact experiments,

particularly with their revelation that during the impact of elastic bodies no momentum is lost.

The analysis of these impact experiments in the light of the second law was very helpful in the formulation of the third law, the law of equality of actions and reactions. Newton's third law employs a terminology the importance of which can not be overstated.

Astronomical evidence supported Newton's answer and this assured the world that a new science, the science of dynamics, was born, and that Newton, inspired by Galileo, was its father. To this new science Newton added his great invention of a new mathematical art, the art of the differential and integral calculus.

Dr. Paul R. Heyl, of the U. S. Bureau of Standards, spoke on "Newton as an Experimental Philosopher."

Newton from his earliest years took delight in constructing mechanical devices, and his innate skill of hand served him well in later years.

Newton is sometimes called "the king of thought" but he was far from being merely a speculative philosopher. His reasoned conclusions were carefully tested by experiment wherever possible.

Newton turned his acquired skill in the making of lenses to what was then the new art of grinding and polishing reflectors for telescopes. So skilful did he become in the construction of such reflectors that the best London opticians could not equal those of his production.

Newton's skill with his hands was in part innate, but we must recognize that his superiority over the professional opticians of his time was doubtless due to the same cause that contributed to the excellence of the work of a certain painter, who when asked the secret of how he mixed his colors replied: "With brains, sir!" Newton's knowledge of geometry guided his technique, and furnished suggestions which could not have been expected to occur to the mind of the artisan of those days.

In his "Principia" as well as in the "Opticks" there is to be found evidence of Newton's skill of hand and experimental ingenuity.

Even the members of the Royal Society, a body of men selected for their excellence in scientific knowledge and attainments and, as the minutes of their meetings show, assiduous experimenters, bore witness to Newton's experimental skill. And yet I think that Newton would have been rather surprised had he heard himself described as an "experimental" philosopher, and would have considered the expression tautological. The scientific specialization of our time was unknown to him. The term philosopher meant then what its etymology signifies—a lover of wisdom, and wisdom (it was beginning to be recognized) was to be found by questioning nature by experiment.

The next paper related to the historical "Developments Following from Newton's Work," in which Professor E. W. Brown traced briefly the work of two centuries in following out the consequences of Newton's laws as applied to the moon and planets. To predict the future position of a heavenly body we must know how it has moved in the past. Some 100,000 observations of the sun and moon alone have been utilized, and besides these many hundreds of thousands of observations of stars have been made to regulate the clock which is of equal importance with the telescope to secure the necessary information. These masses of observations are all bound together into one whole by Newton's laws of motion and of gravitation. The development of the consequences of the laws must be done by mathematical methods and some of the ablest mathematicians have devoted large portions of their lives to the work.

But the laws are not only applicable to the motions of the heavenly bodies, but also to all our terrestrial machinery. The structure of a skyscraper, the safety of a railway bridge, the motion of a motor car, the flight of an airplane, the navigation of a ship across the ocean, the measure of time itself, depend fundamentally on Newton's laws. Many failures of our mechanical devices, especially of those which move at high speed, may be traced to lack of knowledge or lack of care in applying those laws.

The essential characteristic of Newton's laws is their power to predict with certainty. It is a remarkable feat to be able to foretell successfully within a second of time a century hence the moment when the moon or a planet will be observed due south. In the ordinary routine of the astronomer it is regularly done, even more accurately, five years ahead, and the leeway necessary when the interval is extended is known. We have now arrived at the place where we have been able to measure the deviations from the laws themselves as well as the deviation from correct running of our time keeper, the earth, in its daily motion round its axis, but this would not have been possible without the most careful working out of the consequences of the laws. Much remains to be done in applying them to stellar systems, especially globular clusters and spiral nebulae.

The paper from Dr. Florian Cajori, of the University of California, was read by Dr. Lao G. Simons, of Hunter College, who spoke in part upon "Newton's Twenty Years' Delay in announcing the Law of Gravitation."

It is well known that Newton in 1665 or 1666 first tested the law of universal gravitation, but that he did not announce the law until 1686. Before the year 1887, it was universally accepted that Newton's delay

of about twenty years in announcing this great law was due to his having used in 1665 or 1666 too small a value for the size of the earth, so that in applying his gravitational hypothesis to the earth's attraction for the moon, he obtained a theoretical result for the distance a body falls from rest on the surface of the earth in one second which did not agree with the experiment, and that he could not get the two results to agree until the Frenchman, J. Picard, supplied a more accurate geodetic determination for the size of the earth.

At the two hundredth anniversary of the publication of Newton's "Principia," in 1887, the astronomer, J. C. Adams, and the mathematician, J. W. L. Glaisher, advanced another explanation of the twenty years' delay. They stated that in 1666 fairly accurate values of the earth's radius were known and that the real cause of the delay was the question how a sphere attracts an outside particle. This question Newton did not clear up until sometime in 1685, and not until then did he consider valid his proof of the law of gravitation, as applied to the earth and moon.

It is the purpose of this paper to make a searching study of what was really known in England respecting the size of the earth, before Picard made his measurements, and to subject the entire question of Newton's delay to a critical examination.

The paper was divided into five parts, which were as follows: British views of the size of the earth before 1671; Newton's gravitational calculation of 1665 or 1666; Newton's apparent indifference during 1666–1685 to earth measurements; an essential step in proving the law of gravitation, and conclusion.

The first paper for the second morning program was by Dr. L. C. Newell, of Boston University, who also presided at this session, and spoke on "Newton's Work in Alchemy and Chemistry."

Throughout his career as an experimenter in alchemy, Newton was a philosopher searching for a clue to some great generalization concerning the nature and properties of matter.

Although he conducted many chemical and alchemical experiments continuously for about thirty-five years, from 1661 to 1696, in his laboratory beside the great gate of Trinity College in Cambridge, his chief purpose does not seem to have been transmutation of base metals into fine gold, but rather a diligent search for a great principle, which would transform disconnected chemical phenomena into a philosophic system. He was not an alchemist in the usual meaning of the term, with its unethical implications.

Newton's early interest in chemistry is indicated by items in a note-book which has been assigned to his preadolescent years, Professor Newell went on to say. Among the "strictly chemical" items, which the boy had written down, were directions "for making allum water," "How to make lime water," "How to melt mettle quickly yea in a shel," and a prophecy of what chemists of the future were to strive for seriously, "a color for faces."

Newton experimented assiduously in chemistry and alchemy in the many years he spent at Trinity College, Cambridge, as a student, fellow and professor.

Commenting upon Newton's idea of atoms, as set forth in his work on "Opticks," Professor Newell stated that Newton was not far from certain aspects of our modern views on the constitution of matter. Indeed, if this statement of atoms, and if many of the queries propounded in the "Opticks," were stripped of their trappings and rewritten in modern terms, I think we would be compelled to appraise Newton's views as closely approximating modern interpretations of the constitution and behavior of matter.

Dr. George S. Brett, of the department of philosophy, Toronto University, presented a paper on "Newton's Place in the History of Religious Thought."

Newton's relation to the history of religious thought is defined partly by the actual work which he did on passages and books of the Bible, partly by the general influence which he exerted on the thought of the eighteenth century. In this paper reference is made to the specifically theological writings, but more attention is paid to the effects which his ideas of law and order produced upon writers who were concerned to follow his example in reconciling science with religion. The mechanistic philosophy of the eighteenth century was largely due to the attempt of the Newtonians to restate the principles of religion in a way that reconciled them with the idea of a universal reign of law. This idea of law as opposed to the purely sentimental or pietistic view of religion is taken to be the most permanent effect of Newton's work and is held to be the aspect of the subject which most clearly persists to the present time. Though this influence is indirect and is due to the application of Newton's ideas rather than to his own statements, it is the most important aspect of his relation to the progress of thought on religious questions.

George E. Roberts, vice-president of The National City Bank of New York, and formerly director of the United States Mints in Washington, D. C., spoke upon "Newton in the Mint."

Newton's appointment in the mint was eminently fitting in every respect, but not without a political bearing. He had represented the University of Cambridge in the Parliament which established William and Mary on the throne, and Macaulay says that he was the glory of the Whig party. The immediate

occasion, however, was the problem which confronted the government in dealing with the coins in circulation, which had been clipped and debased until the currency situation was intolerable. Macaulay's account of the government's inability to make new coins circulate while this old money was in circulation at the same legal tender value is the classic illustration of Gresham's law that "bad money will drive out good money."

Newton was invited to accept the position of warden of the mint in 1696. It was not the highest office in the institution, but he was made master of the mint three years later, and held that place until his death in 1727. He discharged his official duties with fidelity and energy, particularly during the great recoinage which lasted three years.

The recoinage, however, did not end the monetary problems. When the old silver coins were completely replaced it was found that the new coins were being exported because they were undervalued in comparison with the gold coins, and thus the government was confronted with the problem which vexed the world for the next two hundred years, to-wit, how to make the two metals circulate concurrently upon equal terms under free coinage for both. The government addressed a letter to Newton asking his advice. He replied that silver was sent out of the country because it was more highly valued in proportion to gold elsewhere, and suggested that the gold coins might be reduced in weight, but intimated that it was hardly worth while because the relative values probably would change again shortly. His letter was a model of clarity as far as it went, but became a subject of a controversy between the partisans of bimetalism and the gold standard which lasted until practically the entire world had adopted the gold standard. Both sides sought to use the authority of his great name, but he proposed nothing more than a tentative adjustment of values, for which there were precedents. Evidently he fully comprehended the economic laws governing the fluctuations of the two metals, but he did not discuss the fundamental difficulty involved in trying to maintain two standards of value at the same time, or say anything about the theory of alternative standards.

The last paper, relating to "John Winthrop (1714–1779), America's First Astronomer and the First Disciple of Sir Isaac Newton in the Colonies," was by Frederick E. Brasch, of the Library of Congress, Washington, D. C.

The history of science in the American colonies centered itself in the work of John Winthrop, Hollis professor of mathematics and natural philosophy at Harvard College from 1738 to 1779. Winthrop graduated from the famous Boston Latin School and entered Harvard College where he became the leading scholar of his class. He was appointed to the professorship at the early age of twenty-four years and almost immediately assumed the honor position as a scholar of great ability. His principal work was, however, in the field of astronomy and he made such notable observations upon sun-spots, transits of Mercury and Venus, that he was honored by election as fellow to the Royal Society of London. With the cooperation of the college authorities and the colonial governor he was able to embark upon the first astronomical expedition that this country has ever undertaken, which was in 1761. Winthrop's mathematical ability led him to the more advanced studies which were now to be found in the works of the great Newton, and he soon secured for himself a copy of the "Principia Mathematica," third edition, 1726. This was the second copy known to be in the colonies. Yale College secured the first, namely, the second edition of 1713. The work resulting from Winthrop's studies of the "Principia" now revealed the true character of our scholar, for he was the first to introduce the subject of fluxion (calculus) in the colleges about 1751, also the first to establish a laboratory of physics for experimental purposes in 1746. All Winthrop's subsequent work in astronomy was based upon the "Principia." He was somewhat of a seismologist, as well as having advanced the science of meteorology by his long series of recorded observations, also of the northern lights. During Winthrop's long period at Harvard College he was offered twice the presidency, but refused due to not too good health. He was honored, however, as no man of his time, as a scholar and scientist as well as an ardent patriot, for he espoused the cause of Washington, Adams and others, whose friendship and counsel was always sought. Winthrop was the first scholar to receive the honorary degree of LL.D. of Harvard College, which he also received from the University of Edinburgh. His contemporaries at home and in England recognized Winthrop as the first Newtonian scholar in the colonies. His equals may have been Halley, Bradley and one other in England. Winthrop died at the age of sixty-five years in 1779, and lies buried in the King's Chapel churchyard in Boston, along with his ancestors, the first governor of Massachusetts and the first governor of Connecticut.

The great exhibition of books, portrait prints, letters, autographed documents and medallic illustrations of Sir Isaac Newton, and of his mathematical contemporaries, which supplemented the addresses, were all arranged in suitable cases in three sides of the hall in which the audience gathered. This most imposing collection probably will never be duplicated at any one time and in itself constituted one of the richest con-

tributions to that phase of the history of science which goes to make this subject interesting and fascinating. The labor and excellent arrangement of these beautiful memorials was carried out under the personal direction of Dr. David Eugene Smith. From Dr. Smith's private collection came 125 of the most exquisite and beautiful portrait prints of Newton, of various ages and painters; also 25 medals of about that many engravers and also the largest assortment of letters and autographed documents. Dr. Smith loaned also over 40 various editions of Newton's "Principia," "Opticks," "Fluxions," "Universal Arithmetics," as well as essays on Newton's life and work.

Besides the Newton material from this same private collection came portraits and autographed letters of Halley, Barrows, Cotes, Wren, Wallis, Huyghens, Cassini, all friends and coworkers of Newton. There were also exhibited portraits of Flamsted, Leibnitz, Descartes, Bernoullis, Wolf, Gauss, LaPlace, Gassendi, Pascal, Kepler, Galileo and Copernicus. Most interesting probably was a collection of letters from Leibnitz to Newton with notes in Newton's handwriting. This copy of bound letters was from Newton's private library. Another collection of letters to Newton came from four generations of astronomers royal of France, the Cassini family, to whom Newton was indebted for his data on the size of the earth. From the Babson Institute, Wellesley, came also a magnificent collection of 36 items representing the various editions of Newton's work, the most interesting and valuable being a copy of the first edition of the "Principia Mathematica," 1687, and the reissue of the same book. The first item contained notes and corrections in Newton's own handwriting. Copies of the 1713 edition of "Principia," edited by Cotes, with an enlarged chapter on the "Lunar Theory and of Comets," and the 1726 edition edited by Pemberton, the last published during Newton's lifetime. There was also a copy of Newton's "Opticks," 2nd edition, with notes in his handwriting. All these contained Newton's book-plate and autograph, showing they were from his private library. Besides a collection of portrait prints of Newton, a cast of the sun-dial as well as of his inscription cut on the window sill of the Grantham grammar school made by the boy Newton.

From Mr. George A. Plimpton's (New York) great collection of rare arithmetics came 12 items of Newtonian collected works, as well as single volumes. One item was Newton's copy of a journal with his signature and numerous notes.

Through the courtesy of Dr. A. Koegh, librarian of Yale University, were loaned two books by Newton which have more than passing interest. A copy of the "Principia," 1713 edition, and of the "Opticks," 1706 edition, were presented to the colonial college in New Haven in 1714 by Sir Isaac himself.

Through the courtesy of Dr. L. C. Newell, of Boston University, Dr. S. Brodetsky, Leeds University and Grantham Public Library, came an interesting collection of prints, pamphlets and newspapers giving an elaborate account of the Newton birthplace, of his boyhood and of the bicentenary celebration at Grantham on March 20, 1927.

Six interesting photostat copies of various leaves of a precious commonplace note-book of Newton when a boy of seventeen years were exhibited. The original note-book is in the Pierpont Morgan Library, New York.

Mr. James Stokley, of Science Service, exhibited a copy of Riccioli's Almagestum Novum which came from Newton's library with his annotations, and Dr. Florian Cajori, University of California, exhibited single special items bearing upon Newton's religious writings.

Following are the members of the committee on arrangements: Dr. Lao G. Simons, *Chairman*, Hunter College; Dr. Vera Sanford, The Lincoln School; Miss Frances M. Clark, Teachers College; Miss Helen Walker, Teachers College; Dr. Lester S. Hill, Hunter College, and Mr. John A. Swenson, Wadleigh High School.

FREDERICK E. BRASCH,
Secretary

LIBRARY OF CONGRESS,
WASHINGTON, D. C.

FRANK W. VERY

SUPPLEMENTING the excellent article by H. H. Clayton, in a recent number of SCIENCE, concerning the passing of Professor Frank W. Very, may I be permitted the privilege of adding the sincere tribute of one of his former pupils?

From 1885 until 1895 it was the great privilege of the writer to be associated with Professor Very in the class room and in the field. Every Saturday afternoon, it was Professor Very's delight, in company with a number of young people, to go forth seeking the hidden treasures of field and forest, mine and hill-side, railroad cuttings, and ancient river beds and terraces. With scientific nicety he followed the wonderful trail made by old Mother Nature, and even the most arrant tyro among us was inspired by the keenness of our leader's perception, and the wonderful deductions made by him in the simplest language. We collected fossils, water-worn stones, cocoons, flowers, mosses, lichens, ferns, insects—in fact everything of scientific interest we happened to come across.

And then in the evening we assembled around his study table, either in the Allegheny Observatory, or in his own home, and went over the treasures of the day.

First of all, we were made to draw with scrupulous care the various objects, in order that we might see what was really there. Then there was a great hunting through the library for articles and descriptions. Professor Very superintended this research and illumined what we found with the light of his almost omniscient knowledge. It has never been my privilege to know a man more learned than he in so many different departments of science.

The writer is sure that throughout this broad land, there are thousands who have come under the gracious, kindly influence of Professor Very, and who will endorse these words of tribute to a great teacher.

J. GORDON OGDEN

FIFTH AVENUE HIGH SCHOOL,
PITTSBURGH, PENNSYLVANIA

SCIENTIFIC EVENTS

EXPEDITION TO COMBAT SLEEPING SICKNESS IN FRENCH AFRICA

THE organization of a government expedition to fight sleeping sickness in French equatorial Africa is reported by the New York *Herald*. Thirty-three French physicians and scientific men, under the auspices of the Pasteur Institute, will devote five years to combatting the disease and attempting to rid the colonies of the fatal tsetse fly.

Accompanying the decree authorizing the expedition was a letter from Leon Perrier, minister of colonies, to President Doumergue, stating that the present conditions in Africa made necessary special efforts to stamp out sleeping sickness above all other diseases.

The minister said sanitary conditions had become worse, due to the concentration of native labor in connection with railroad building. He suggested that, owing to the hazardous nature of the task and the length of service necessary, special awards be offered to those who volunteer. This was provided in the decree issued by the president. M. Perrier said he had suggested the expedition after consultation with the Pasteur Institute and that the director of the institute's branch at Brazaville had named a technical adviser for the expedition. Enlistment in the expedition is open to both army and civilian scientific men.

The decree signed by President Doumergue fixes the size of the party at ten physicians, ten hygienists, one veterinarian and twelve hospital attendants, all Europeans, and 105 natives. While the salaries are not unusually high—28,000 francs a year for the physicians and 18,000 and 13,000 for the other classes—they are offered many immunities from taxation and allowances for their families.

In addition they will be given a bonus of 10,000 francs after two years' service, 30,000 after four years and 60,000 if they enlist for an additional two years' service. The last clause implies that the government intends to keep the expedition in operation longer than the original five years mentioned in the decree.

The volunteers must pass three months in study at the Pasteur Institute in Paris or at the branch at Brazaville. They must enlist for two years' continuous service, followed by a vacation of six months, and then for another two years without interruption.

CASTING OF A LARGE DISK OF OPTICAL GLASS BY THE U. S. BUREAU OF STANDARDS

THE *Technical Bulletin* of the U. S. Bureau of Standards gives an account of the casting of a large disk of optical glass for Ohio Wesleyan University. On January 21 the mold containing the disk of optical glass, cast on May 7, 1927, was opened and the glass found to be very good. It appears to be quite uniform throughout, and although it contains some seeds and striae, they will not affect its value as a telescope mirror.

The cover was removed in the presence of several distinguished scientists, including Dr. S. W. Stratton, president of Massachusetts Institute of Technology; W. R. Warner, of the firm of Warner and Swasey, telescope makers, and Dr. George K. Burgess, director of the Bureau of Standards.

The disk, which is about 70 inches in diameter, 11 inches thick and weighs 3,500 pounds, will be used as a great concave mirror for the new reflecting telescope of the Perkins Observatory at Ohio Wesleyan University, Delaware, Ohio.

The money with which to establish this observatory was left to the university by Professor Hiram Mills Perkins, of Ohio Wesleyan, who during 50 years of hard work through most rigid economy and sound investment had been able to amass a small fortune, nearly a quarter of a million dollars. It was his desire to establish an observatory of the first rank at the university and that the entire equipment be of American manufacture. The mounting of the telescope was constructed by the American telescope makers, Warner and Swasey, of Cleveland, Ohio, but difficulty was experienced in getting any bids on the mirror from American glass manufacturers. In particular, no one was willing to state, even approximately, when the disk could be completed. Finally, the director of the observatory, Dr. Clifford C. Crump, called upon the Department of Commerce for assistance. Although the Bureau of Standards has been

making optical glass since 1914, no task approaching the magnitude of the present one had ever been attempted.

After four unsuccessful attempts to obtain a disk of the size required a unique method was developed by the bureau's glass section. Cullet (broken glass of the same composition as the glass to be made) to the amount of 1,000 pounds and 4,600 pounds of sand and chemicals were melted in a single large pot in a gas-fired furnace.

The temperature of the glass when poured on May 7, 1927, was about 1,350° C. For one week the temperature was slowly lowered until it reached 600° C. The glass was held at this point for about four days to allow the temperature of the glass and furnace to become uniform throughout. At 600° C. this particular kind of glass (borosilicate crown) is quite rigid and yet sufficiently viscous to yield to cooling stresses without danger of cracking.

Beginning on May 18 the glass was allowed to cool slowly at an average rate of 2½° C. per day till 460° C. was reached. It was then annealed at this temperature for six weeks, during which time no variation greater than 1° C. was permitted. Final cooling was started on August 30, and room temperature was attained on January 16.

EXPERIMENT STATION OF THE GEORGIA STATE COLLEGE OF AGRICULTURE

THROUGH its president, Dr. Andrew M. Soule, the Georgia State College of Agriculture announces the establishment of an Experiment Station within the institution, this station to be supported *in toto* from the funds of the institution. For several years problems in farm management, fertilization of agronomical crops and fruit plants as well as ecological studies of the horticultural plants have been conducted. As soon after the first of January, 1928, as feasible, full-time research members of the staff will be appointed in the divisions of agricultural chemistry, agricultural engineering, animal husbandry, horticulture, poultry, marketing and home economics.

The experiment station will be in the hands of a committee of which President Andrew M. Soule is chairman. The responsibility for coordinating and general supervision of the experimental work will rest on the secretary of the research committee who has been designated for this position by the board of trustees.

The formation of the experiment station within the Georgia State College of Agriculture will be completed during the year of 1928. There will be ten full-time research members on its staff, and with these will be associated three Purnell workers already at the college in cooperation with the Georgia State Experiment Station.

It is with a great deal of pleasure that the announcement of this experiment station is made, for we feel that the agriculture of Georgia is certain to reap large benefits and profits from the work of these men who will be in a position to put their whole time on solving the problems of Georgia's farms and homes.

T. H. MCHATTON,
Secretary of Research

AWARD OF THE CHARLES REID BARNES LIFE MEMBERSHIP IN THE AMERICAN SOCIETY OF PLANT PHYSIOLOGISTS

AT the recent Nashville meeting, the second award of the Charles Reid Barnes honorary life membership in the American Society of Plant Physiologists was made to Professor Francis E. Lloyd, MacDonald professor of botany in McGill University, Montreal. This form of honorary life membership was inaugurated at the Kansas City meeting, in 1925, in memory of Charles Reid Barnes, who died at Chicago on February 24, 1910, in the midst of an active life. All who worked with Barnes at the University of Wisconsin or at the University of Chicago remember him as an exceptionally inspiring teacher, a man of untiring industry and wonderful ability. Through his publications and especially through his editorial work on the staff of the *Botanical Gazette* from 1882 to the time of his death, as well as through the work of those who received their training in his laboratories, Barnes left a permanent and indelible imprint of his remarkably clear and precise thought upon the whole science of plant physiology.

A Charles Reid Barnes honorary life membership is awarded each year, at the annual meeting of the American Society of Plant Physiologists. The first award was made at the Philadelphia meeting last year, to Burton E. Livingston, professor of plant physiology of the Johns Hopkins University and permanent secretary of the American Association for the Advancement of Science.

Professor Lloyd, who now becomes the second Charles Reid Barnes life member of the American Society of Plant Physiologists, was born in Manchester, England. He attended Lafayette College and Princeton University, receiving the degrees of A.B. and A.M. at Princeton in 1891 and 1895, respectively. He was a student at Munich in 1898, and at Bonn in 1901. He was instructor in biology at Williams College, 1891–92; professor of biology and geology 1892–95, and of biology 1895–97, at Pacific University, Oregon; adjunct professor of biology in Teachers College, Columbia University, 1897–1906. In 1907 he

was connected for a brief period with Harvard University. He was a staff member of the Desert Laboratory, 1906; cytologist of the Arizona Agricultural Experiment Station, 1907; director of the department of investigation of the Continental-Mexican Rubber Co., 1907–08, and professor of botany in the Alabama Polytechnic Institute, 1908–12. Since 1912 he has held the MacDonald professorship of botany at McGill University. He has been a member of a number of scientific expeditions to Mexico, Puget Sound and Alaska, Dominica, Java and Sumatra.

For several years he was editor of *Plant World*, is now an associate editor of the *American Review of Tropical Agriculture*, and a member of the editorial board of *Plant Physiology*, the journal of the American Society of Plant Physiologists. Professor Lloyd has published many contributions in the field of botany, including the comparative embryology of the *Rubiaceae*, the morphology and physiology of the Mexican rubber plant guayule, the physiology of stomata, transpiration, tannin metabolism, fluorescent pigments, colloidal phenomena and the physiology of plant growth. His recent work, employing motion pictures to record the activity of conjugating cells of *Spirogyra* and the habits of *Vampyrella*, on which he has reported at recent meetings of the American Society of Plant Physiologists, has attracted much attention, and has thrown much light on the difficult field of protoplasmic physiology.

Professor Lloyd is a member of many scientific societies in this country and abroad, and is recognized as one of the most able and inspiring teachers and as one of the most distinguished investigators in American plant physiology. The American Society of Plant Physiologists expresses its appreciation of his important contributions in awarding to Professor Lloyd the second Charles Reid Barnes life membership in the society.

The Committee on the award of the first Charles Reid Barnes Life Membership of the American Society of plant Physiologists: Lee M. Hutchins, Walter F. Loehwing, Walter E. Loomis, James S. McHargue, Frank M. Andrews, chairman.

SCIENTIFIC NOTES AND NEWS

THE president and council of the Royal Society decided at their meeting on February 16 to recommend for election into the society the following fifteen candidates: Dr. Gleb V. Anrep, Professor Harry Bateman, Professor Carl Hamilton Browning, Mr. Stanley Smith Cook, Mr. William David Dye, Professor Clinton Coleridge Farr, Professor Major Greenwood, Dr. John William Heslop Harrison, Professor Walter Norman Haworth, Dr. David Keilin, Dr. Finlay Lorimer Kitchin, Dr. Francis Sowerby Macaulay, Professor Samuel Barnett Schryver, Professor Walter Stiles and Professor Robert Whytlaw-Gray.

IN connection with the tercentenary celebration by the College of Physicians of London of the publication of William Harvey's book, "De Motu Cordis," the Earl of Balfour, Sir Ernest Rutherford, Professors Ivan Petrovitch Pavlov and Karl Friedrich Wenckebach are to be made honorary fellows of the college.

DR. HENRY LE CHATELIER, honorary president of the French Society of Industrial Chemistry, has been made an honorary member of the American Society of Mechanical Engineers. The presentation was made on February 28 by Charles M. Schwab at a luncheon at the American Embassy in France.

DR. MICHAEL I. PUPIN, professor of electro-mechanics at Columbia University, was recently given the Washington award by the Western Society of Engineers at Chicago in recognition of his work on long-distance telephony and the radio.

PROFESSOR MAYNARD M. METCALF, of the department of biology of the Johns Hopkins University, has been elected a foreign member of the Société de Biogéographie de Paris.

DR. J. C. TH. UPHOF, professor of botany and head of the department of biology at Rollins College, Winter Park, Fla., has been elected a member of the Deutsche Botanische Gesellschaft.

DR. E. E. SLOSSON, director of Science Service, had conferred upon him the honorary degree of doctor of science at the founders' day exercises at Rollins College on February 20.

ON the occasion of the Washington Birthday celebration at the University of Pennsylvania, the honorary degree of fine arts was conferred upon Dr. R. Tait McKenzie, director of physical education at the university.

AT their annual meeting held on February 8, Dr. Charles Greeley Abbot, secretary of the Smithsonian Institution, was elected director of the Research Corporation of New York, to succeed the late Dr. Walcott.

JULIAN C. SMITH, vice-president and general manager of the Shawinigan Water and Power Company, Montreal, was installed as president of the Engineering Institute of Canada for 1928 at the institute's recent annual convention.

DR. LINSLEY R. WILLIAMS, former deputy commissioner of the State Department of Health, has been elected president of the New York Tuberculosis and Health Association to succeed Dr. James Alexander Miller, who retires after nine years' service.

The Sigma Xi Alumni Association of the University of Pittsburgh has elected the following officers for the year 1928: *President,* Dr. Oswald H. Blackwood (physics); *vice-president,* Dr. L. P. Sieg (physics); *secretary,* Dr. Alfred E. Emerson (zoology). The active membership of this association consists of 85 Sigma Xi alumni on the staff of the University of Pittsburgh.

The following officers and new members of the council of the Royal Astronomical Society have been elected: *President,* Rev. T. E. R. Phillips; *vice-presidents,* Professor A. S. Eddington, Professor Alfred Fowler, Dr. J. W. L. Glaisher, Lieut.-Col. F. J. M. Stratton; *treasurer,* Dr. E. B. Knobel; *secretaries,* Dr. John Jackson, Dr. H. Knox-Shaw; *foreign-secretary,* Professor H. H. Turner; *new members of council,* Professor S. Chapman, Sir Frank Dyson, Mr. W. M. H. Greaves, Dr. Gerald Merton, Professor E. A. Milne.

At the anniversary meeting of the Royal Anthropological Institute, held on January 24, Professor J. L. Myres was elected president in succession to Mr. H. J. E. Peake, whose term of office has expired. The vacancy for a vice-president was filled by the election of Professor H. J. E. Fleure, and Mr. G. D. Hornblower was elected honorary treasurer in succession to Dr. F. C. Shrubsall.

Perkins Coville, for the past five years instructor in forestry at Iowa State College, has been appointed assistant silviculturist, a new position in the U. S. Forestry Service. He will assume his new duties on July 1, in Washington.

Dr. Bernard O. Dodge, of the U. S. Department of Agriculture, has been appointed plant pathologist at the New York Botanical Gardens.

Ralph A. Morgan has resigned from the development branch of the Western Electric Company, to take charge of the research and development work for Black, Swalls and Bryson and their subsidiary corporation, the Cleaners' Equipment Corporation.

Dr. George N. Walcott, formerly entomologist at the Insular Experiment Station, Porto Rico, and more recently with Service Technique, Haiti, has accepted a position with the sugar-cane and cotton experiment station in Peru. He is sailing from New York on April 12.

At the Missouri Agricultural Experiment Station, Dr. Hans Jenny, of the Agricultural Chemical Experiment Station of Zurich, Switzerland, has been given an appointment in the department of soils, substituting for Dr. Richard Bradfield, who is spending a year's leave of absence at Kaiser Wilhelm Institute in Berlin.

Dr. Cornelis Lely, president and honorary member of the Netherlands Royal Institute of Engineers, was the guest of honor at a luncheon given at the Engineers' Club on March 6, under the auspices of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Dr. John R. Freeman presided.

Walter Granger, paleontologist, and Leslie E. Spock, geologist, with their associates, James B. Shackleford and Albert Thomson, sailed from San Francisco on March 2 to join the Central Asiatic Expedition of the American Museum of Natural History. In Peking they will meet Dr. Roy Chapman Andrews, the leader, now getting together a camel caravan, with which it is planned to start for the desert of Mongolia by mid-April.

Professor R. A. Cooley, professor of zoology at Montana Agricultural College, will leave on April 1 for a year's leave of absence. He will spend part of the time in the interior of Africa with the Chicago zoological expedition and will study tick parasites.

Dr. Henry C. Sherman, Mitchill professor of chemistry at Columbia University, has been granted a leave of absence for the spring session.

Professor F. E. Wood, of the department of mathematics at Northwestern University, is spending the year in research in Bologna and Rome.

Dr. Albrecht Penck, professor of geography in the University of Berlin, has accepted invitations to lecture at the University of Chicago during June and at the University of California during July.

Dr. George R. Minot, professor of medicine at the Harvard Medical School, will deliver the fifth Harvey Society lecture at the New York Academy of Medicine on Friday evening, March 16. His subject will be "The Treatment of Pernicious (Addison's) Anemia."

Dr. Frank C. Mann, of the Mayo Clinic, delivered the fourth L. L. McArthur lecture of the Billings Foundation before the Chicago Institute of Medicine on February 24 on "Experimental Peptic Ulcer."

Professor Arthur H. Compton, of the University of Chicago, was the guest of honor at the annual banquet of the Iowa chapter of Sigma Xi on February 29 and gave an illustrated public address under the auspices of the society on the subject "What Things are Made of."

Dr. Irving S. Cutter, of Northwestern University Medical School, will give a Mayo Foundation lecture

at the Mayo Clinic on April 6 on "Some Sidelights on the Etiology of Puerperal Fever." This lecture is one of a series on medical history.

DR. CHESTER DARROW, of the Institute for Juvenile Research, Chicago, delivered an illustrated public lecture at Colgate University on February 28 on "Recent Developments in the Use of the Galvanometer in Psychology."

ON February 18, Dr. L. R. Jones, professor of plant pathology at the University of Wisconsin, delivered an address to the Royal Canadian Institute on the subject "The 'Survival of the Fittest' in the Field of Plant Pathology."

THE council of the Royal Medico-Psychological Association has decided to commemorate the life work of the late Sir Frederick Mott by publishing a memorial book, and for this purpose has appointed a committee consisting of Drs. C. Hubert Bond, F. L. Golla, Douglas McRae, Thomas Beaton and J. R. Lord.

DR. HARRIS HAWTHORNE WILDER, since 1892 head of the department of biology at Smith College, died on February 27, aged sixty-four years.

DR. CHARLES F. DAWSON, formerly assistant chief of the U. S. Bureau of Animal Industry and professor of bacteriology at the University of Florida, died on February 28, aged sixty-seven years.

DR. R. S. HOLWAY, emeritus professor of physical geography at the University of California, died on December 2, aged seventy years.

DR. W. L. JOHANNSEN, professor of plant physiology in the University of Copenhagen, died on November 11.

THE United States Civil Service Commission announces open competitive examinations for associate agricultural engineer at a salary of $3,000 and assistant agricultural engineer at a salary of $2,400, applications for which must be on file with the commission not later than March 27. The examinations are to fill vacancies in the Bureau of Public Roads, Department of Agriculture, for duty in Washington, D. C., or in the field, and in positions requiring similar qualifications.

THE central petroleum committee of the National Research Council will meet in New York on March 17 to make recommendations to the American Petroleum Institute for research projects to be conducted during 1928–29 under the research fund contributed by Mr. John D. Rockefeller and the Universal Oil Products Company. Suggestions and proposals for research projects should be sent to the chairman of the committee, Professor Hugh S. Taylor, Princeton University, to reach him before March 15. Announcements on the research projects will be made before April 1.

FREE public lectures on medical topics will be given under the auspices of the Chicago Academy of Sciences and the North Side Branch of the Chicago Medical Society at the Chicago Academy of Sciences, at 3:30 P. M. on Sundays as follows: March 18, "Preventive Medicine," Dr. Nathan Smith Davis III; March 25, "Heart Disease in Childhood," Dr. Harold A. Bachmann; April 1, "Cults, Quacks and Cures," Dr. Morris Fishbein; April 15, "Tuberculosis," Dr. Ethan Allen Gray; April 22, "The Pre-School Child," Dr. Gustav L. Kaufmann; April 29, "The Prevention of Contagious Disease," Dr. Archibald L. Hoyne.

THE American Institute of Mining and Metallurgical Engineers, which recently held its annual meeting in New York, will convene in Boston next September. Electrical prospecting and the new geophysical methods now being used for the discovery of ore will be studied and discussed in technical sessions at this meeting.

PHI chapter of Tri Beta, honorary biology fraternity, was installed at Peru College, Nebraska, on February 13, by Dr. Wm. M. Goldsmith, of Southwestern College, Winfield, Kansas.

THE *British Medical Journal* states that the centenary celebration of the faculty of medicine at Cairo and an international congress of tropical medicine and hygiene will be held in association from December 15 to 22, 1928, in that town. In the provisional program which has just been issued, it is stated that various sectional meetings will be held and that special attention will be paid to ankylostomiasis and bilharziasis. In connection with this celebration a medical exhibition is being arranged, and it is possible that the foundation stone will be laid of a new building to replace the existing Kasr-el-Ani Hospital.

ACCORDING to the *Geological Magazine* the Geological Survey of Denmark will celebrate its fortieth anniversary in June, by a series of meetings and excursions to which foreign geologists are to be invited. Previous to the meeting in Copenhagen an excursion will be arranged to Bornholm, Denmark's outlying rocky island in the Baltic, which is replete with stratigraphical and all sorts of geological interest. Another party is to visit Moën and Zealand, where remarkable dislocations in the Senonian Chalk can be seen and studied. The conference will be devoted to lectures and discussions on the geology of Denmark, interspersed with inspections of the Copenhagen museums, with their collections of minerals, fossils and pre-historic remains. Afterwards, an eleven-day excursion will enable foreign geologists to visit and in-

spect a wide range of glacial phenomena in Zealand, Funen and Langeland, as well as on the mainland in Jutland.

IN view of the disastrous floods which have occurred in the United States during the past year and the fact that congress at its present session will discuss legislation relating to flood prevention, schools of engineering in the country will be interested in the visit of two distinguished men from Holland who will lecture on flood prevention as exemplified in the reclamation of land from the Zuider Zee. Dr. Cornelis Lely, the distinguished engineer of Holland who originated the plan of draining the Zuider Zee, is expected to visit the United States this winter, arriving the latter part of February. He expects to lecture in the colleges in the east during the month of March. Mr. Plate, president of the Shipping Association in Rotterdam, with many years of experience in engineering in Holland and the Dutch East Indies, will arrive in New York on February 15. He will lecture on the same subject *en route* to San Francisco and upon his return trip to Ann Arbor. The fact that these men will visit different parts of the country will make it possible for engineers to become familiar with the methods used in Holland with the reclamation of land from the Zuider Zee. The Institute of International Education, 2 West 45th Street, New York City, is arranging the itineraries of both of these lecturers.

AT the League of Nations assembly in September a report was presented on the work of the League's Committee on Intellectual Cooperation. The report, according to an account printed in *Nature*, directs special attention to the creation at the International Institute of Intellectual Cooperation of a coordination service of information offices attached to libraries, to the committee's proposals for coordination between the organs of bibliography for the various sciences, to the need of funds for the maintenance of the office for annual tables of constants and mathematical quantities, and to the steps taken in preparation for the Popular Arts Congress (to be held at Prague in 1928), for an international agreement with regard to casts, and for promoting the extension of the educational work of museums. It is also pointed out that additional funds are needed for the institute, grants to which are at present made only by the following countries: Austria, Czechoslovakia, France, Hungary, Italy, Monaco, Poland and Switzerland. The question how to protect and reward men of science and their discoveries by means of an international convention has been investigated during the past five years, and it is now thought that the matter is ripe for definite action. It is intended, therefore, to convene a committee of experts to prepare a draft convention. A separate report was submitted on the Italian proposal for the creation of an educational kinematographic institute. This proposal looks to the creation at Rome of an institute under the direction of the League of Nations, but to be carried on at the expense of the Italian government.

DR. WILLARD R. JILLSON, director and state geologist of the Kentucky Geological Survey, announces the completion of a unit set of thirty structural oil and gas and geological maps of eastern Kentucky. The maps are issued by the Kentucky Geological Survey at the scale of 1 inch to the mile, and taken as a unit constitute the largest area, structurally mapped on the same keybed—the Fire Clay coal—in the world. The district covers 10,500 square miles. This work initiated in 1918 has just been completed with the release of the Harlan County sheet.

A HISTORY of the world's development, told in chronological exhibits of the birds, mammals and terrain of each period, has been begun by Dr. Frank C. Baker, curator of the museum of the University of Illinois. Every general type of bird has been arranged in ordinal periods. The development of birds during each era, showing the types, nests, eggs, skeletons and reproductions or actual display of plumages, is illustrated. Partially completed now are exhibits of the Cambrian, Ordovician, Silurian, Devonian, Mississippian and Pennsylvanian periods.

THE Wilder medal, one of the highest awards made by the American Pomological Society, has been given to the Canadian Government Central Experimental Farm, Ottawa, for the Melba apple, which was originated at the Ottawa farm. This is the eighth time that the Wilder medal has been awarded to the Canadian Government Experimental Farm for notable varieties of apples.

DR. R. S. BASSLER, of the U. S. National Museum, writes that a pamphlet on the international rules of zoological nomenclature has been published by the Biological Society of Washington, copies of which can be had by addressing the secretary of that society, care of the U. S. Bureau of Entomology.

BEGINNING next September, a new department of agriculture will be inaugurated in Carthage College, Carthage, Illinois. A two years' course will be offered which will coordinate with the work offered at the University of Illinois.

THE Louisiana State University is adding to its summer curriculum a field course in zoology at some near seaside point, probably at the foot of Barataria Bay. The course is to be open to students who have had preliminary training and will be conducted with

emphasis upon the local marine fauna. It is hoped that students from other southern schools and instructors interested in research upon local marine forms will join the undertaking.

A LARGE number of specimens of plants, birds, mammals and insects are included in the collections brought back by the Lee Garnett Day expedition to Mount Roraima, according to an announcement by the American Museum of Natural History. A total of 1,260 birds, some 350 mammals and many plants and insects were sent back by the party. The members of the expedition were G. H. H. Tate and T. D. Carter, of the museum's department of mammalogy, and Mr. Tate's brother, G. M. Tate, who joined them after traveling from Para, Brazil, up the Amazon and Negro Rivers to Manaos, thence by boat and canoe to the confluence of the Rivers Surumu and Cotinga. From there the journey was made in eleven days on foot.

PURCHASE of the plant collections of the late Dr. L. M. Umbach, of North Western College, Napierville, Ill., has added about 50,000 specimens to the University of Wisconsin herbarium. The acquisition practically doubles the collections of the university, and makes it one of the largest herbariums of middle west plants. Included in the addition are also collections from other parts of the country, from Europe, some from Asia and elsewhere.

IT is reported that the Rockefeller Foundation has given to the Stockholm High School 25,000 crowns for a building for a biochemical institute, with Professor Hans Von Euler as director. A like sum has been raised in Sweden.

THE Puget Sound Biological Station of the University of Washington, located at Friday Harbor, Washington, is erecting a fireproof store room 24 x 56 feet and a fireproof research laboratory, 31 x 73 feet. These are to be finished by June 1.

UNIVERSITY AND EDUCATIONAL NOTES

THE University of Chicago has received a gift of $250,000 from Mr. Julius Rosenwald to be used for graduate work and research in the departments of physics, mathematics and astronomy.

SIX friends of Wesleyan University have pledged a total of $600,000 to the centennial committee. The aims for the centennial year include a fund of $1,000,000 to raise the faculty salaries and to provide adequate pensions for retired faculty members.

DR. EDWARD HICKS HUME, former president of Yale-in-China, has been appointed to the newly created post of director of the Post-Graduate Medical School and Hospital at Yale University. Under the new organization, the dean of the medical school, the superintendent of the hospital and the principal of the school of nursing will all be responsible directly to Dr. Hume, who in turn will be responsible to the board of directors.

DR. GARY N. CALKINS, professor of protozoology in Columbia University, has been named executive officer of the department of zoology for three years.

HAROLD GOULDEN, formerly of the Squibb Laboratories, has been appointed an instructor in the department of biochemistry of the New Jersey College of Pharmacy.

ASSOCIATE PROFESSOR LAO G. SIMONS has been promoted to a full professorship and head of the department of mathematics at Hunter College.

A. J. WILSON, professor of analytical chemistry at North Carolina State College, has been appointed chairman of the department of chemistry for the remainder of the session, succeeding Frank E. Rice.

M. E. DELAFIELD, head of the department of public health and hygiene at University College, London, has been appointed to the university chair of chemistry as applied to hygiene tenable at the London School of Hygiene and Tropical Medicine.

DR. F. G. TRAYHORN has been appointed professor of chemistry at University College, Hull.

DR. SIGURD, of Freiburg, has succeeded Professor Trendelenburg in the chair of pharmacology at Berlin.

DISCUSSION AND CORRESPONDENCE

TREE FROGS AND PITCHER PLANTS

IT is well known that the regions where the southern pitcher plant (*Sarracenia flava*) abounds may also be the home of the carolina, or green tree frog (*Hyla cinerea*), but an association between them has not been noticed. However, the following observations seem to show that these frogs make use of the pitcher plant, though this may prove to be no general rule but only a local habit, possibly restricted to special conditions of weather.

In June and July, 1888, an examination of some of the pitcher plant leaves growing in abundance in the wet lands amidst pine groves close to Beaufort, North Carolina, showed that not a few of the leaves were inhabited by tree frogs. The leaves of this plant form beautiful yellow-green trumpets that stand straight up, in clusters, so high that one is naturally tempted to look down into their wide mouths to the water and insects that may be down in the narrowly

pointed base. In this way it was noticed that now and then a leaf contained a tree frog. These frogs having exceptionally long legs and slender trunks seem especially well shaped to fit into any narrow cavity and as they sat holding to the side of the trumpet some distance down from its mouth where they yet had ample room, they presented very quaint and attractive pictures. The color of these frogs being a yellow-green with some golden spots, they harmonized excellently with the background illuminated by light in part transmitted through the walls of the leaf.

The frogs sat with their heads up toward the mouth of the pitcher or trumpet, and were advantageously placed to seize any insect that might come down into the cavity of the leaf. That this was a chance worth considering was perhaps indicated by the fact that in some cases small spiders had spun their webs across the opening of the leaves, thus being placed well to intercept the insects that might else have gone down to the frog.

In the latter part of June and the first of July as many as twelve frogs were found, on two days, a week or more apart, while looking into about six hundred leaves. That this occurrence of frogs in the leaves was not limited to the above cases was proved by a third examination made July 9, when just two hundred leaves were looked into as they came; one hundred in the locality previously visited and the other hundred in a new locality. In both cases the leaves examined were on plants growing along the edges of the woods where the frogs were probably more numerous than out in the open where the pitcher plants were more numerous. The first hundred leaves contained three frogs; the twenty-ninth leaf harbored two frogs and the thirty-sixth one. The second hundred contained five frogs; one in the fourth, in the fifty-sixth, fifty-eighth, sixty-sixth and eighty-seventh. Thus in these leaves skirting the woods some two to five per cent. contained frogs.

The season being then very dry the occurrence of the green-tree frog in the leaves of the pitcher plant may have been an unusual occurrence due to the frogs seeking protection from drying; on the other hand, this frog may have developed a special appreciation of the advantages of these retreats, both as affording food and as giving the comparative immunity from attacks of enemies that the protective resemblance of the frog to the leaf suggests.

E. A. ANDREWS

THE JOHNS HOPKINS UNIVERSITY

THE OCCURRENCE OF CONJUGATION IN PARAMECIUM CALKINSI

Paramecium calkinsi was described as a new species in 1921 by Woodruff[1] after he had carried pedigreed cultures of it for nearly a year and had made various tests to determine that the new species belonged to the genus Paramecium. Woodruff states that every effort was made to secure conjugation, but without success. He further states that during the life of his pedigree culture an intensive study of the nuclear conditions was made to detect endomixis if it occurred. There was no indication of endomixis, although there were rhythms in the rate of fission. So far as we are aware, neither Woodruff nor any other investigator has succeeded in inducing conjugation in *P. calkinsi* and we have seen no record of endomixis having been observed. One of us (Wenrich) has made repeated but unsuccessful efforts to induce conjugation in a strain of this species obtained from Professor Woodruff.

As a result of all these failures to observe conjugation or endomixis, the impression has been developing that these phenomena do not occur in this species. In view of the important theoretical implications of such an exceptional behavior on the part of a distinct species of Paramecium, it seems worth while to record here the fact that conjugation has been observed in cultures of *Paramecium calkinsi* secured originally at Woods Hole, Mass.

The original material was a sample of water taken from the pond on the east side of the Eel Pond at Woods Hole. The water in this pond is brackish, since at high tide sea water from the Eel Pond flows into it; at other times during the day, it drains into the Eel Pond. The material collected from the source pond on August 18, 1927, contained large numbers of *Paramecium calkinsi,* and some of it was distributed into syracuse watch glasses for more convenient culture and study. At the beginning of September, each of these cultures was placed into a vial and transported to Philadelphia. On September 5 each of these cultures was reestablished in a syracuse watch glass without change of media. On September 7 it was noticed that in culture number 5 many individuals had died, so a new culture, 5A, was made, by transferring about 200 individuals to another watch glass containing an infusion made by boiling together some timothy hay and wheat grains. The old culture was made over by taking out most of the fluid and replacing it with the infusion just mentioned. Within the next few days other cultures were replenished with the hay-wheat infusion. Examination on September 16 showed heavy populations in both cultures 5 and 5A and some dozens of pairs of conjugants. Conjugation has since been observed in five others of the

[1] "The Structure, Life History, and Intrageneric Relationships of Paramecium calkinsi," Sp. Nov. *Biol Bull.*, Vol. 41, pp. 171–180.

cultures brought from Woods Hole; and in the original culture, No. 5, a smaller or larger number of conjugating pairs were observed almost daily up to October 15, 1927.

The question presents itself as to the causes of the failure of Woodruff's strain to conjugate, in comparison with the apparent readiness to conjugate on the part of the Woods Hole strains. The differences may be attributed either (1) to the difference in the original habitat, (2) to different culture methods in the laboratory or (3) to inherent racial differences, or some combination of these. In regard to the first possibility, it will be remembered that Woodruff's strain came from a fresh-water source while the Woods Hole strains have come from brakish water. Experimental tests demonstrated that these brakish-water strains would live in an apparently normal condition in fresh water and in various strengths of sea water up to pure sea water, provided the changes to the higher strengths were made gradually. The brakish-water habitat may therefore be considered a normal one.

In regard to the second possibility, it may be pointed out here that we have subjected Woodruff's strain to the same cultural conditions that we used for the Woods Hole strains, but have not as yet been able to induce conjugation in this strain. The evidence at present available rather favors the third possibility—that of inherent racial differences.

Segregated strains are being established from exconjugants and it is hoped to make an intensive study of the conditions which will induce conjugation as well as to investigate thoroughly the cytological details of the process.

D. H. WENRICH,
C. C. WANG

ZOOLOGICAL LABORATORY,
UNIVERSITY OF PENNSYLVANIA

CENTRIFUGING FILTERABLE VIRUSES

I READ with interest the note by M. S. Marshall, entitled "Centrifuging Filterable Viruses," which appeared on page 219 in SCIENCE of September 2, 1927. There seems to be little doubt as to the accuracy of Marshall's computations, and it seems likely that his conclusions are correct for a pure virus in water. However, it should be pointed out that his conclusions do not hold for virus which is in the plant extract. The writer's studies show that the virus of tobacco mosaic can be concentrated by means of the supercentrifuge. These investigations were published in *The Journal of Agricultural Research*, vol. 35, pp. 13–38, July 1, 1927. It should be pointed out that the supercentrifuge has been used in this and in other laboratories for concentrating bacteria and other micro-organisms. See the article by C. Juday, in the *Transactions* of the Wisconsin Academy of Science, Arts and Letters, vol. 22, pp. 299–314. 1926.

The writer's studies indicate that physical and chemical treatments which cause coagulation and precipitation to take place in plant extracts, also cause or assist the virus to settle out of the extract. However, the relative advantages of the various treatments, and the exact relations between the virus particles and other particles which are precipitated out of the extracts, are not fully known. Some treatments are less desirable than others because they are toxic to the virus in varying degrees. Some treatments produce only very finely divided coagula which do not settle out on long standing. Frequently these are heavily charged with virus, and they can be removed almost completely by means of the supercentrifuge.

It should be emphasized that centrifuge methods are of unquestionable value in studies on the virus of tobacco mosaic, and thus far the writer has found the supercentrifuge to be one of the most useful pieces of apparatus in the laboratory.

H. H. MCKINNEY

CEREAL VIRUS DISEASE INVESTIGATIONS,
BUREAU OF PLANT INDUSTRY

COLORIMETRIC METHODS IN BIOLOGY

PAST discussions of colorimetry, in the pages of SCIENCE, and particularly the recent appeal by Irwin G. Priest for bibliographic references and reprints bearing on this subject, have emboldened me to call attention in your columns to a paper of my own, published during the past year. I refer to an article entitled "Linear and Colorimetric Measurements of Small Mammals," which appeared in *The Journal of Mammalogy*, vol. 8, no. 3, August, 1927, pp. 177–206.

I hope that this unseemly bit of self-advertising on my part will be condoned for the following reasons. The scope of the journal in which the paper was published would doubtless tend to conceal it from the view of many biologists who are not especially interested in the Mammalia. On the other hand, the methods therein described are doubtless applicable to a wide range of biological and even of inorganic objects.

The writer is far from wishing to pose as an expert on colorimetry, either practical or theoretical, but he has been dealing for many years with color differences in certain species of rodents, and has been obliged to treat these differences quantitatively. Since no recognized technique was available for the purpose, it was necessary to work this out through protracted experimentation. A type of instrument (the Ives Tint Photometer) was finally adopted, which was already in use for industrial purposes. Some further equipment was necessary, however, and

the details of the procedure were not finally standardized until the lapse of several years. I have been fortunate enough to have had the advice of several persons who are far better informed in this field than I am.

These remarks are offered in the hope that they may be of service to some of those who wish to treat the colors of biological objects in a quantitative way. It is not claimed that the procedure adopted by me records absolute values, or ones which are accurate enough for the exacting requirements of physics. But it is, so far as I know, the only practicable method yet offered for measuring individual and racial differences of color and shade in the pelages of mammals, and it renders possible the treatment of these characters according to familiar biometric procedure.

F. B. SUMNER

SCRIPPS INSTITUTION OF OCEANOGRAPHY

SPECIALIZATION AND COOPERATION IN SCIENTIFIC RESEARCH

PROFESSOR COMPTON'S interesting address delivered at Lehigh University and printed in SCIENCE of November 11, 1927, brings up pointedly the question as to whether the conception of mass production is to dominate the teaching of advanced physical science. Two remarkable statements on this subject have recently come, one from the Bishop of Ripon who pleaded for a ten-year holiday in research at the recent meeting of the British Association, and the other statement from Sir Ernest Rutherford, the president of the Royal Society, which was made at the opening of a new physics laboratory at the University of Bristol. "When I look back over the thirty years or more of my connection with research," says Sir Ernest, "I am conscious that I have always been looking for a breathing space when, for a few years, no advances of consequence would be made; when I should gain an opportunity for studying in more detail, at my leisure, the ground already won. Alas, that breathing space has never come, and I am sure will never come in my time."

A plea for limitation of the intensive methods of research which are at present advocated and practised in our universities is unpopular. But the intensive methods are bringing on very peculiar results. The quantity of "research" output has grown to be immense. It is not unlike the production of motor cars. The aim is not the very best, but something new and "salable." Anything that is good enough to hold its own is good enough to be produced as a piece of "research." An enormous amount of duplication has followed in the wake of this mass research. This is very noticeable in connection with the issue of electrical patents many of which are granted on devices which have been clearly described ten and twenty years previous to the date of the applications. Some very extraordinary examples might be cited in this connection besides the one referred to by Professor Compton.

The thesis work is growing more intricate and complex. In the majority of cases it must be difficult to secure proof of the accuracy of much of the work done. But it is new, or it appears new, and that suffices. Now, in the historical development of science we have the example of Darwin holding his manuscript of the Origin of Species for twenty years, checking and re-checking before publishing. It would not be difficult to name other examples though less noted. If this so-called research work were more carefully done, its rate of increase would slow down of its own accord. If scientific teaching was set into the proper historical relief, it would be more thoroughly done and there would be less of it. When we plead for the teaching of fundamentals it is this which we mean. It is not clear whether Professor Compton pleads for teaching the "easiest way" by following altogether the inclinations of the students. The kind of research work he refers to is a little like athletics and much of it can be done without a long systematic training but such training is the essence of science. If the test is to be utilitarian, science as we like to see it taught will depart. If the criterion is to be that taught and urged by such teachers as Huxley and Helmholtz, then it is the "truth" which is the standard. Constant care as to whether new work is worth publishing, whether previous workers have received the credit which their work deserves, whether experiments are accurately made, whether the theory is simplified to the point where it is something other than a cloud of symbols, such considerations would, of their very nature, slow down this high speed production and permit, to some extent, the realization of the hours of philosophic contemplation of the work already done for which Sir Ernest Rutherford makes his plea.

Mass production in science may prove to become as fatal as it is likely to become in industry, where it bids fair to be master instead of servant.

B. A. BEHREND

WELLESLEY HILLS, MASS.

A FUNCTION OF REGIONAL SCIENTIFIC SOCIETIES

ONE thing of prime importance to be stressed by regional groups of scientific workers which seems to have been entirely forgotten by the various secretaries of State Academies of Science as reported by Professor Segerblom, SCIENCE, October 16, is the incentive for young researchers which comes from being per-

itted to report their work in these meetings. The riter has distinctly in mind the attitude of the under-raduates toward a certain sophomore who had dis-overed the continuity of protoplasm between cells of a filamentous alga and had been permitted to report his before a State Academy of Science. The effect perhaps was as important on the sophomore as on his associates, for his name is now one of the starred list of botanists in American Men of Science. In itself the discovery may or may not have been important, but the effect was important on that student body. In this day of great stadia and unlimited honor to heroes of beef and bone, it should occur to scientists to devise some method of making scientific honors for undergraduates a thing worth the seeking. In those days of the Indiana Academy, when the influence of Jordan and Coulter was strong, democracy prevailed, and the student of science in the colleges of the state felt that to appear before the academy was almost as important as winning his degree. To the veteran it may be important to be reminded that the borders of the unknown are near at hand by bits contributed from unexpected sources. The best that can prevail for the promotion of research is that spirit which knows only the rank of ability.

Though not of the group of which the study was made, it may interest some to know that the models of the Indiana and the Wisconsin Academies were well in the minds of the organizers of The Northwest Scientific Association when that organization began four years ago. Here the senior or the young graduate meets on equal footing with the doctors and the deans of colleges, chancellor, president or professor, and fine fellowship prevails among all. The groups which were isolated and unknown to each other in the widely scattered colleges now meet and are getting well acquainted and learning to work together. The present membership is nearing three hundred. The program for December 28 and 29 announced seventy-four titles. Nine different sections are now under way and twenty-five sessions of breakfast, luncheon, dinner and general or section meetings convened.

Northwest Science, the official organ of Northwest Scientific Association, has now completed its first year and in a way represents the work accomplished by that organization. It has printed a history of the organization for three years of its existence, abstracts of papers presented at the meetings, some regional news, a few general papers and one issue devoted to the geology of the region on either side of the line between Idaho and Washington in the locality of Spokane.

THOS. LARGE

SPOKANE, WASHINGTON

CHILDREN WHO RUN ON ALL FOURS

IN the last two numbers of *The American Journal of Physical Anthropology* (Wistar Institute, Philadelphia), the undersigned publishes the account, with illustrations, of eleven children who before walking upright have spontaneously developed the habit of running effectively on all fours. This is a highly interesting phenomenon of nonpathologic nature, and he would be thankful for further reliable reports. The principal points on which information is desired are as follows: 1. Race and nationality; 2. Sex; 3. Health and robustness; 4. What child in numerical order; 5. Has the phenomenon been noticed in any other child of the same parents or among relatives; 6. At what age has the child begun to run on all fours and how long has it continued. To which should be added a description, as detailed as possible, of the performance itself, supplemented when this can be done by a photograph of the child in the act. The position of the hands (whether fully open or partly closed), and of the head, while running on all fours, as well as any other peculiarities of the child's behavior, are matters of interest.

ALEŠ HRDLIČKA

DIVISION OF PHYSICAL ANTHROPOLOGY,
U. S. NATIONAL MUSEUM

SCIENTIFIC BOOKS

The Antiquity of Man in East Anglia. By J. REID MOIR. Cambridge University Press, 1927.

THIS invaluable volume is not, like many of the contemporary works on the Old Stone Age, a restatement of current archeological knowledge or of current Continental research in archeology, but is an entirely fresh and convincing presentation of a series of wonderful discoveries in the newest field of prehistoric archeology which were made in the counties of Norfolk and Suffolk, a region collectively known as East Anglia.

The title chosen by the author does not fit the contents of this volume because he has assigned an age of only 500,000 years and the geologic epoch of merely Lower Pleistocene time to discoveries which in the reviewer's opinion belonged to a far more ancient period, namely, 1,250,000 years, and to a more ancient geologic epoch, namely, the close of Pliocene time. This is less surprising when we consider that English geologists for the most part still speak only of two glacial periods and, with the exception of Brooks, there is little serious attempt to connect these two ice invasions of British territory with a fourfold Ice Age of western Europe and of North America. The

author, moreover, is under the very strong influence of Sir Ray Lankester, who insists that Upper Pliocene time in Great Britain corresponds to Lower Pleistocene time in other parts of Europe. Yet Lankester has rendered a courageous service to archeology in his strong support of Mr. Moir's contention for the artificial character, especially of the flints known as rostro-carinates, which are distinctive of what the reviewer would call the Upper Pliocene of Great Britain and thus far have not been found elsewhere, except as degenerate survivors in a subsequent archeological stage. These are the only two exceptions found by the present reviewer in this invaluable collection of most original observations in Norfolk and Suffolk, extending back to the year 1909 when the author made his first discovery and was attracted to this fascinating and absorbing subject. In previous writings, the present reviewer has also stoutly espoused the cause of Mr. Moir against much indifference and incredulity not only among English but among Continental archeologists, and has supported his successive discoveries as far ante-dating in geologic age those made in any other part of the world.

The author opens with the chapter entitled "The Pleasures of Flint Hunting." It is this pleasure or, more truly, this fascination guided by real genius that has led him to devote every spare moment of his time to thorough, repeated and well-rewarded research in localities which offered the best promise or prospect of revealing traces of prehistoric man. His outstanding discoveries are those of the Foxhall quarry and fireplace, which he suggests may be of the same age as the Piltdown skull, the rostro-carinate bed lying *beneath* the classic Red Crag of East Anglia and the giant Cromer flints on the foreshore of Norfolk in the most unpromising locality exposed only at low tide. In each case, he has been rewarded with most brilliant achievement and final recognition of the authenticity of his findings by such acute European archeologists as Breuil and Capitan. He is himself a master of the art of flint-making and has worked out many of the stages of early manufacture and adaptation, even of the long-disputed types of flints known as Eoliths. His firm opinion on this subject, as evidenced in the following quotations, is, therefore, entitled to a most serious consideration.

> The human origin of the Eolithic, Kentian, flint implement has been in dispute for a great number of years, but the weight of opinion is now in favor of the view that they were artificially flaked, especially as they are seen to conform to the criteria of man's work upon flints. The primitive appearance and profound antiquity of these specimens make them of the greatest interest to students of prehistoric man.

> Though, as has been shown above, there is very good reason to believe that the Eoliths of the Kent Plateau are of a very great antiquity, yet the gravel in which they are found is not covered by any other deposit such as would enable us to say, with certainty, that this gravel is of a particular geological age. It is fortunate, therefore, that examples of Eoliths, quite comparable with those discovered in Kent, have been found in Suffolk, in the detritus, or bone bed, below the Red Crag, thus showing that the very ancient people who made these implements inhabited East Anglia.

* * * * * *

> The Eoliths are thus, evidently, of an extreme antiquity, and represent the most ancient works of man yet brought to light. In my opinion also these specimens show us the basic forms from which all later flint implements were derived, and I have been able to trace the manner in which the Eoliths developed into the later sub-Red Crag forms, and these, in their turn, to the still more advanced Palaeolithic specimens. It can not be too strongly urged that the evidence now to hand demonstrates the orderly development of flint implements from the very primitive Eoliths to the latest, symmetrical forms in use at the end of the Stone Age, and that this development, indicating as it must the slow, though sure, advance of man himself from a rudimentary pre-human state, provides further support, if such were needed, to Darwin's great theory of evolution.

In these passages, he not only commits himself to the theory of human origin of the Kentian Eoliths but goes still further back to those of Darmsden and Puy Courny. As to the latter, he says:

> . . . It is, therefore, of great interest to realize that at Puy Courny, in Central France, there is present a bed of gravel of Upper Miocene Age (the epoch immediately preceding the Pliocene) containing a large series of examples of cherty flint that assume very definite Eolithic forms. . . . There can not, fortunately, be any doubt as to the age of this deposit because in it have been found the remains of the following Upper Miocene animals, *Dinotherium giganteum, Mastodon longirostris, Rhinoceros Schleiermacheri,* and *Hipparion gracile.* The specimens in the Westlake collection impressed me strongly with their very primitive appearance, and I think it probable that they are comparable with the oldest series recovered by me from below the Red Crag of Suffolk. If this view is correct, then we can at last form some idea of the age of these earliest human implements, and realize that they must be referred to the end of the very remote Miocene epoch. . . . Henri Breuil, who has also seen this collection, regards the specimens it contains as of natural, rather than as of human, origin.

Altogether this is the most original and welcome contribution which has ever been made to Tertiary archeology as distinguished from Quaternary archeology which began with the great discoveries of the Chellean culture on the River Somme by M. Boucher de Perthes. Whether we accept Mr. Moir's interpre-

ation of the Miocene Eoliths or not, we must give him irst rank and accord to him the full priority of the iscovery of indisputable flint work of man in Ter- iary time. It is too early to draw all the theoretic onclusions regarding the antiquity and ancestry of nan which may be deduced from these discoveries, but in the present reviewer's opinion, they vastly ex- tend our conception of a truly human and pre-human ype of Dawn Man rather than of an ape-man an- estry of our race.

H. F. O.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A PHOTOGRAPHIC PLATE THAT PENETRATES DESERT HAZE

GEOLOGISTS and others who have occasion to take photographs of distant mountains in the arid regions have often been afflicted by the presence of the blue haze that obscures the details of features more than a few miles away. This is presumably caused by the fine dust which the desert winds keep more or less continuously suspended in the atmosphere.

Ordinary photographic plates and films give but poor results under such conditions. The photograph generally shows much less of detail than the eye itself can see, and hence one is apt to be disappointed. By the use of ray filters or color screens, some improvement may be effected, but at best it falls far short of satisfaction.

By using panchromatic films and orange or red ray filters, very much better pictures can be obtained. Cut films or plates of this type are now rather generally used by the more experienced and painstaking photographers of mountain scenery. Unfortunately they are not yet available in the form of roll-films.

Further steps were taken some years ago by Messrs. Burns, Shane and Wright at the Lick Observatory (Mt. Hamilton, California), who, for the purpose of photographing distant landscapes, used plates treated with Krypto-cyanine, a dye which confers sensitivity to a narrow range of color near the red end of the spectrum. The plates have, of course, the usual sensitivity to blue and violet light, but, with the aid of a ray filter which excludes those colors, one may photograph a scene entirely by deep red light. In this way the blue rays, scattered by the dust particles, are eliminated, and a sharp clear picture may be obtained even at a distance of 25 miles and more. Even minor details stand out with a distinctiveness that is remarkable; and it is just such details that are generally the concern of the geologist.

With the addition of a suitable ray-filter (deep yellow or red) the red sensitive plates generally require, under normal conditions, an exposure of about one second, with stop f. 8 to 11.

It must be admitted that there are some objectionable features about the photographs thus obtained. The sky appears black; but if there are clouds present their whiteness relieves that appearance. Again, dry grass, and certain kinds of trees and shrubbery take on a whiteness that suggests a new fall of snow. However, these drawbacks may be considered of secondary importance, provided the chief need is for clear pictures through a hazy atmosphere. By means of these plates it is possible to obtain photographs that show details which the eye itself can not see at the time.

It was the sight of a remarkable photograph of the Sierra Nevada, taken by Mr. Wright from Mount Hamilton, that first drew the writer's attention to the red sensitive plates. The fact that Half Dome and other details of the Yosemite gorge could be clearly recognized although 115 miles away showed clearly that the ever-present blue haze had been definitely neutralized.

ELIOT BLACKWELDER

STANFORD UNIVERSITY,
CALIFORNIA

MODIFIED WATER REGULATOR FOR SMALL TANKS

IN the annual report of the department of oceanography of the University of Liverpool (London, 1925), H. C. Chadwick describes a new device for regulating the outflow of water from small aquaria. Since this device is quite practical and since its description is found in a publication (*Transactions* of the Liverpool Biological Society) of relatively small circulation in the United States, it may not be out of place to reprint Mr. Chadwick's original account in this journal.

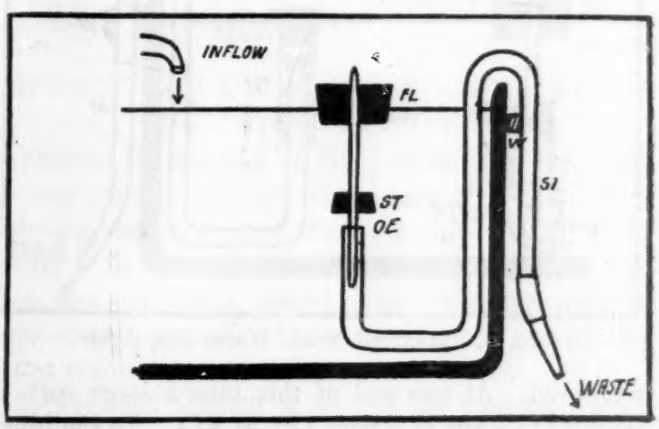

FIG. 1. Chadwick's Tank Water Regulator

The apparatus (Fig. 1) consists of a length of glass tubing 6 mm. in internal diameter, bent as shown in

figure. The open end (OE) of the tube was ground on a fine carborundum stone, so as to be exactly at right-angles to the bore of the tube. FL is a good sound cork 1¼-inch in diameter and ¾-inch thick, rendered impervious to water by prolonged immersion in melted paraffin wax. Through a central hole is inserted a piece of glass tubing 4½ inches long and having both ends completely closed. It slides easily up and down in the vertical portion of the siphon SI. About an inch below the cork float, and sliding tightly on the tube so that its position may be varied, is a slice cut cleanly and exactly at right angles from a rubber cork (ST). To bring the apparatus into action it is immersed in the water of the tank (about 5 inches deep) and held in position by a wedge of cork (W) as shown in the figure. The water is drawn through the siphon (SI), and the longer end of the tubing carrying the cork float and the rubber stopper is dropped into the open end (OE), so that the stopper rests upon and closes it. Water is supplied to the tank, and as its surface level rises the rubber stopper is lifted from the aperture, thus allowing a rapid flow through the siphon. This slowly lowers the surface level until the stopper again rests upon the aperture and obstructs the flow. The waste aperture being only 2 mm. in diameter the siphon remains full until the stopper is again lifted. It has been found by experiments that the cork float should have ample buoyancy, so as to easily counteract the suction of the outgoing current.

The main shortcomings of this device are (1) that the glass rod to which the float and stopper are attached is entered into the siphon, thus impeding the free outflow of the water; and (2) that there is no way of preventing small organisms from being sucked into the siphon and thus lost.

These shortcomings, however, are readily removed in the following manner.

1. Instead of using a glass rod, a short glass tube (Fig. 2A, TU), somewhat wider than the siphon, is

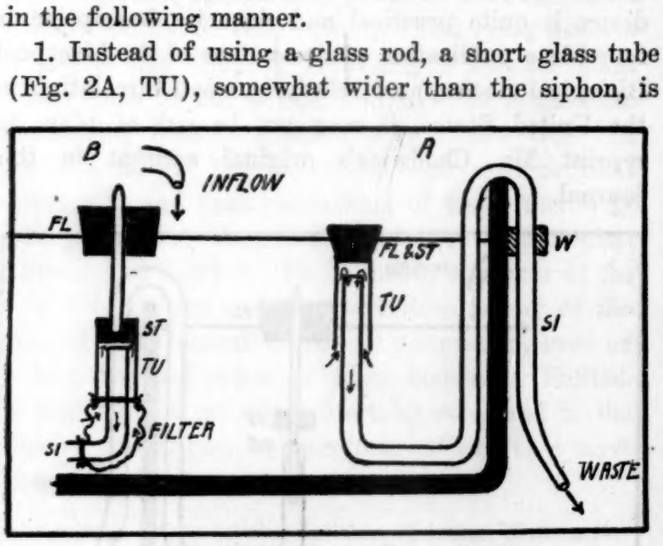

Fig. 2. Modified Tank Water Regulator

employed. At one end of this tube a large cork is inserted to serve as a float (FL & ST). To the inner end of this cork, a rubber gasket is attached in order to obtain a perfectly flat surface to close the open end of the siphon. The tube is now filled with water and placed over the inner end of the siphon in the manner shown in figure 2A.

2. The large float suggested by Chadwick is used in combination with the device described in the previous paragraph (Fig. 2B). However, the glass rod connecting the large float and the stopper should not be made to enter the siphon but should end inside the stopper. A tube of silk cloth (FILTER) should be tied to the lower end of the short glass tube (TU) and to the siphon, not tightly stretched, but in such a manner that the movements of the stopper are not obstructed.

The important points to be observed in making this apparatus are: 1. the tubing for the siphon should not be too wide gauged. 2. the open end of the siphon and the stopper should fit perfectly. 3. the float should be sufficiently large to overcome the suction in the siphon.

Finally, it may be added that instead of a one-sided wedge (W) to support the outer shank of the siphon, a pierced cork is more practical.

Tage Skogsberg

Hopkins Marine Station,
Pacific Grove, California

SPECIAL ARTICLES

SOME DEVONIAN PLANT LOCALITIES OF CENTRAL AND WESTERN NEW YORK

During the past few years a systematic investigation of possible plant localities in the Devonian outcrops of central New York has been in progress. As a result of these investigations plant material with preserved structure has been found in at least half a dozen localities, and there are good prospects of additional discoveries in localities yet to be investigated.

In 1924 Professor L. C. Petry[1] reported and briefly described a specimen from the Genundewa limestone on the west side of Canandaigua Lake at Cheshire, New York. This specimen showed mesarch primary wood strands at the margin of the pith, in contact with secondary wood in which the pits on the radial walls were segregated into groups of five to thirty-five each. These groups are arranged opposite each other in adjacent tracheids so that when the wood is viewed in radial section a characteristic cross banding is observed. To forms bearing these characters Zalessky[2] has assigned the generic name *Callixylon*.

[1] Petry, L. C., "On Fossil Plants showing Structure, from the Upper Devonian of New York." Paper read before the American Association for the Advancement of Science, Washington, D. C., 1924.

[2] Zalessky, M. D., "Etude sur l'anatomie du Dadoxylon Tchihatcheffi Goeppert sp." Mem. du Comité Geol. de Russe. Nouvelle Série 68: 29, 1911.

At Seneca Point, about five miles south of this locality, and in the Genundewa horizon, several more pieces of preserved wood have since been found. These specimens were enclosed mostly in nodular masses of grayish limestone and associated with the pteropod *Styliolina fissurella*. In the same locality, but in the Genesee shale immediately below, several excellent specimens have been found. Some of them represent complete woody cylinders but devoid of cortex and phloem, and range from one fourth inch to two inches in diameter. In some of these specimens the mesarch primary wood has been preserved and most of them show the grouped arrangement of the pits. These wood fragments were found in concretions of dark, dense limestone which are very abundant in the Genesee shale. However only a small per cent. of these concretions contain recognizable plant remains.

Directly across Canandaigua Lake from Seneca Point and in the Genundewa horizon more material was found. No preserved primary wood was found in these specimens, but in many cases the secondary wood was in good condition. The pits on the radial walls of the xylem cells are grouped in the same manner as described above.

On the west side of Cayuga Lake some well preserved plant material was found in a rock fall in the gorge just below the main falls of Taughannock Falls State Park. The secondary wood, which shows the grouped pitting, is in the best state of preservation of any material yet examined. The primary wood is in poorer condition. The exact horizon from which these materials came has not been determined, but the concretions within which they were enclosed closely resemble those of the Genesee shale. The Genundewa limestone is not recognizable above the Genesee shale in this locality.

During the autumn of 1926 several fragments of preserved wood were found in an outcrop of the Ithaca shale on the Cornell University campus. They consisted of both roots and stems, the largest being about three fourths of an inch in diameter. While the preservation in these specimens is rather poor, the nature of the primary wood and the pitting can be determined in some cases. A feature of interest in one of these specimens lies in the fact that the horizontal banding due to the grouping of the pits is not constant throughout the stem, but can be observed in only a few places. The majority of the tracheids show continuous pitting of the *Dadoxylon* type. These fragments did not occur in concretions as did the others but were in a bed of solid limestone of rather localized extent. Associated with the plant remains were numerous large brachiopods. This horizon is about five hundred feet above the Genundewa horizon where, or near where, most of the other material was found.

Mr. A. E. Alexander, a student at Cornell, has recently submitted a specimen from the Ludlowville shale, Spring Creek, Erie County, New York. In this specimen the wood structure has been preserved with marcasite. This material being perfectly opaque, the structure can not be studied in thin section. Consequently its exact nature has not been determined but the tracheids show two or three rows of alternately arranged hexagonal pits which are not grouped after the *Callixylon* fashion.

With the exception of the last the localities above described cover an east and west range of about fifty miles across central New York. The vertical range is about five hundred feet. They all belong to the lower part of the upper Devonian, and in every locality mentioned (except the last) *Callixylon* seems to be the predominating plant type. The locality in Erie County belongs to the middle Devonian.

The fragmentary nature of this material suggests that it was not deposited *in situ*, but represents pieces of drift wood which floated some distance before being buried and preserved. It is generally agreed that the Genesee shales, where some of the material was found, were deposited in a rather stagnant sea, and the material itself apparently represents dry land vegetation. No preserved cortex or phloem has been found in association with any of the material.

Some of the materials show faint suggestions of growth rings. In no case are they well marked and in many specimens there is no evidence of them at all. Where they do occur the cells we assume to be the summer wood have a slightly smaller radial diameter than the adjoining spring wood. In case of a stem which has been slightly crushed flattening of the cells seems to occur to a greater extent along the region of the ring.

CHESTER A. ARNOLD

CORNELL UNIVERSITY

EFFECT OF ULTRA-VIOLET LIGHT UPON DIGITALIS PURPUREA[1]

DURING the summer of 1927, an opportunity arose to test the influence of shorter rays of light upon a common medicinal plant, Digitalis purpurea or "Foxglove." In a five-section greenhouse, the center section was built of a special glass which transmits a considerable portion of the spectrum in the ultra-violet region.[2]

It was thus possible to develop the seedling plants

[1] Paper read before the Botanical Society of America, December 28, 1927.

[2] Acknowledgment is due The Vita Glass Corporation, of New York, for their cooperation in making this study.

under full exposure to these rays, while control plants in the same greenhouse were entirely out of range and received light only through ordinary, plain glass.

Seed was planted in the usual flats; and the experiment proper began when these seedlings were in the small, two-leaf stage. They were then arranged for study in two series as nearly identical as the eye could determine, each of which consisted of 160 plants.

INDOOR CONDITIONS

One series was placed under the special glass, the other under the plain glass. Henceforth, they were given identical care, keeping all other conditions uniform; soil, ventilation, moisture, and temperature as closely as possible. (A two or three degree higher temperature occurred at times under the plain glass, but at no time was it of any significance as plants were out of the greenhouse before this became high enough to be a factor).

For about six weeks, between late March and mid-May, plants were kept under close observation, and the advantage in growth was found to lie continually with those under the special glass. The second, third, and fourth pairs of leaves developed from two to four days earlier than the respective parts of the control plants. Treated plants were also somewhat larger and of darker green than the controls. Because these seedlings were to be used later in field work, no dry weight or ash determinations were made. Judgment was based upon careful consideration by four observers, including the gardener and the writer.

Seedlings used were of *D. purpurea,* and, so-called, *D. purpurea* var. *alba.* The former has typical purplish-red flowers; the latter, white flowers. The purple type, or "race," Group A-7, is somewhat sturdier than the white, Group C-23; but both give thrifty, typical plants.

OUTDOOR DISPOSAL

To decrease the chances of accident, seedlings were hardened in cold frames only five days, after holding in greenhouse until danger from frost was over. They were then transferred to the open Demonstration Garden, May 24, 1927, and set out in four adjacent rows, placing plants one yard apart each way. At this time, all were good, vigorous seedlings; but those which had the benefit of ultra-violet light were unquestionably the better in appearance.

Michigan weather last summer was very dry, but, by very frequent cultivation to conserve moisture, all plants lived. Although, at the time of the first harvest, August 10, 1927, none of the plants were above normal in size, the treated ones were still the larger. The difference, however, was no longer so striking.

PHYSIOLOGICAL TEST: FIRST CUTTING

Four samples were taken at this time, two from each group. To prepare a sample, the first twenty plants in a row were cut and the leaves well mixed. All samples were dried under uniform conditions. The crisp leaves were then crushed by hand and again thoroughly mixed before milling.

Tinctures were prepared by U. S. P. Method, and turned over with routine samples for physiological testing, which is done by the M. L. D. Frog-heart Method. Results obtained, shown in Table I, rather strikingly indicate that the stimulus received in seedling stage is carried over under field conditions.

TABLE I

First crop 8/10/27

Plants tested	Potency of Tincture		Increase of potency
	Exposed under special glass	Exposed under ordinary glass	
Group A–7	500% of St'd.	400% of St'd.	25.00%
Group C–23	335% of St'd.	300% of St'd.	11.66%

PHYSIOLOGICAL TEST: SECOND CUTTING

To provide a check series, the cut plants were allowed to grow again until September 27, 1927, when a second test was made, extreme care being taken to repeat in every detail the previous procedure. For this cutting, plants were at least 50 per cent. larger than before, due to a very favorable fall season with continual fine weather and frequent warm showers. So far as the eye could detect, there was at this time no difference between the two series; the plants not treated had "caught up" to the treated ones in size and general appearance. It is, therefore, the more interesting to note, Table II, that the potency was again higher, in each group, in the drug exposed to the ultra-violet rays during development of seedling stages.

TABLE II

Second crop 9/27/27

Plants tested	Potency of Tincture		Increase of potency
	Exposed under special glass	Exposed under ordinary glass	
Group A–7	400% of St'd.	300% of St'd.	33%
Group C–23	300% of St'd.	225% of St'd.	35%

These plants have all been mulched and, if they survive the winter, will be followed during their second-year stage. Meantime, it seems clear-cut that, so far as may be judged by one year's study, exposure to ultra-violet light is beneficial to both growth and potency of Digitalis purpurea.

ADELIA MCCREA

PARKE, DAVIS AND COMPANY,
DETROIT, MICHIGAN

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SCIENCE NEWS

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CHANGES IN THE EARTH'S ROTATION

EVERY day the earth changes a little in its rate of rotation.

This is the opinion of Dr. Benjamin Boss, director of the Dudley Observatory at Albany, and director of the department of meridian astrometry of the Carnegie Institution of Washington. Furthermore, this variation appears to be related to the frequency of earthquakes, and so further investigation of it might aid in the study of quakes.

Dr. Boss has found evidence for this apparent variation in a long study of star positions. At the Dudley Observatory an exhaustive catalog of star places is in preparation, and in the work on this it has been found that a considerable correction, which varies annually, is needed for the right ascension of the stars. The right ascension is the celestial equivalent of longitude. As a telescope permanently placed on the earth would point to different right ascensions in the sky as the earth turns, any change in the rate of the earth's rotation would affect the right ascensions of the stars.

For sometime, says Dr. Boss, it has been known that the sun, the moon and the planets Venus and Mercury undergo changes indicating the variable rotation of the earth over long periods of years.

The annual change in the star positions can be explained by daily variation in the rate of rotation of the earth. Possible evidence in favor of such a variation is suggested when checking clock time with the stars, for it has been found that there is a daily variation in the clock rate, which indicates that the earth may change daily in the rate of its rotation.

That the changes in the moon and stars are both due to the same cause is indicated by the fact that when the minor fluctuations in the moon's path, and the variation in star positions, are plotted over a long period of years, the curves are closely similar. About 1860 both curves reached a minimum, while about 1900 they were both at a high mark. Since that they have been going down, until 1920, when the moon fluctuation reached a minimum. For the last ten years the figures for the star variations have not been completed, but they also seem to have reached a minimum about the same time. Dr. Boss believes that this indicates very strongly that the two variations are due to the same cause.

What this cause may be is not certain, but Dr. Boss thinks that it is very likely to be the result of tides in the earth. This view is supported by the fact that Dr. A. A. Michelson, of the University of Chicago, has actually obtained experimental evidence of earth tides. Ocean tides are not sufficient to account for the observed phenomena, but if the outer crust of the earth is in a condition such as recent investigation supposes it to be, tidal friction might appreciably affect the rate at which the earth turns.

According to Dr. Boss, the tide might produce the long period changes by the fact that the crust of the earth, lifted at high tide, fails to settle back to its original position. Thus the earth's diameter is gradually increased, slowing its rotation. When a critical point is reached, it gradually starts to settle, speeding up rotation.

AUTOMATIC CONTROLS

A FEW turns of copper wire around an iron core is able, in many places, to do the work of a man! With the recent demonstration of a "mechanical man" to unveil a portrait of George Washington by a telephoned signal attention has been called to other ways of performing routine tasks either by remote control of an operator, or even without any operator at all.

The televox, by which the portrait was unveiled, depends upon a device that responds to a sound of certain frequency, but not to another. Stand in front of a piano, put your foot on the loud pedal, and whistle a note. Then stop whistling, and you will hear the piano continue to emit the same note. This is because the sound waves of your whistle set in vibration the piano string tuned to that particular note. Other strings, tuned to other notes, or to air waves vibrating at a different rate, fail to respond, just as a radio set will not bring in a broadcasting station unless it is tuned to waves of the proper frequency. With the televox, the receiving apparatus is tuned to a particular frequency of sound. A musical note, either from a tuning fork or a whistle, is telephoned to it. A relay, which is simply an electromagnet with a movable armature arranged to come against it when the current flows through the coils of the magnet, operates when the proper note is sounded. This in turn may start a motor, turn on or off a light, or do any one of a number of mechanical operations. By having several units of the apparatus, each with its relay, a complicated performance may be gone through by sending a series of different notes. These may, if wished, be so adjusted that the notes form a tune.

So far this particular device has only been used with land telephone lines, but it could be easily adapted to radio. Experiments have been made for many years with radio-controlled automobiles and other machinery, but in many cases these devices used several radio wavelengths, instead of different sounds, each performing a certain task.

Entirely automatic operation has in many instances made it possible to dispense with the human element completely. For instance, lights on buoys and light-houses have been operated with a selenium cell, with which light regulates the flow of an electric current. As soon as darkness comes, the light is turned on, when daylight breaks, the light goes off.

Another form of automatic control has been used in electrical substations, where formerly it was necessary

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Applications for fellowships or requests for further information may be addressed to the Chairman of the Physics Department, New York University, University Heights, New York, N. Y.

NEW SCIENTIFIC BOOKS

The Macmillan Company, New York

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EXPERIMENTAL RADIO. R. R. Ramsey. pp. xii. + 229. $2.75.

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RESEARCH IN THE HUMANISTIC AND SOCIAL SCIENCES. Frederic Austin Ogg. 454 pp. $2.50.

Being a report of a survey conducted for the American Council of Learned Societies. It covers the research work done by learned societies, colleges, universities, bureaus, foundations, business houses and individuals.

Harper & Brothers, New York

PLANE TRIGONOMETRY. WITH TABLES. N. J. Lennes and A. S. Merrill. Edited by H. E. Slaught. $2.20 with tables. $1.60 without tables. Tables alone $1.20.

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to keep an operator in constant attendance. Electric current comes over the lines from the power plant to the substation, from which it is redistributed, perhaps at a lower voltage, to the users. When the load is heavy, certain transformers may have to be turned on, while different ones would be required when so much current is not needed. In such cases relays can be used so adjusted that when the load reaches a certain point, the necessary switches are closed, while they are turned off when the load is lightened.

THE SHORT-WAVE, HIGH-POWER VACUUM TUBE

A VACUUM tube with a power of 15,000 watts, sending out radio waves of only six meters length, that can light electric lamps without wires or socket, produce a warmth in nearby spectators reminiscent of prohibited stimulants, and cook sausage in a glass tube without fire, is one of the latest radio wonders. It has just been demonstrated at the General Electric Company's research laboratory.

The new tube, known as the ZT–6, looks harmless enough. It is about five inches in diameter, and two feet long, set in a wooden cage and surrounded by a network of wires, condensers and meters. With its great power of 15 kilowatts, it is at least fifty times as powerful as any short-wave tube previously constructed. Through a coupling system it is connected to a copper bar about three meters, or ten feet, long, which acts as the tuned aerial circuit, radiating the full 15 kilowatts into space.

When an ordinary electric lamp is touched to the copper bar, it lights up brilliantly. A loose copper rod, lying on the floor, is picked up, and, though cold, it blisters the hand. When a person approaches the apparatus, he first feels a warm glow, then pain in the limbs and joints. Artificial fever, as much as 100 degrees Fahrenheit, is induced after standing close to it for 15 minutes.

This may indicate one of the future applications of the tube, says Dr. W. R. Whitney, director of the laboratory. "If we had a perfectly harmless method for warming the blood it might have value," he stated, "because fevers are sometimes artificially produced in order to start convalescence, and it may well be, as asserted, that raised blood temperature, or fever, is one of nature's factors in the recovery from infectious diseases."

Another feat of the apparatus, which also involved the heating of animal tissue without fire, was the cooking of a sausage in a glass tube, suspended from a wire some distance from the transmitting aerial. An apple was placed on the end of this receiving aerial and in a few minutes it was thoroughly baked to the core.

One of the most spectacular "stunts" performed was the imitation of the famous but seldom observed "ball of fire" reputed to accompany tropical thunderstorms. When the end of the radiating aerial was touched with a metal-tipped pole, a greenish-white arc arose to a height of a foot or more. This arc remained, even after the pole was removed, like a plume of fire, sputtering and sending out molten copper in all directions until it was blown out. As many as three of these standing arcs, each without any visible return circuit, were established along the bar at once.

ADVANCES IN TELEVISION

A SMALL crystal of quartz, less than an inch thick, has now simplified television by taking the place of a complete telephone line or radio transmitting and receiving equipment. This is the latest achievement of the Bell Laboratories, which perfected a process of television first demonstrated nearly a year ago.

With practically all methods of television so far invented it is necessary to have a disc at the receiving end rotate in exact synchronism with a similar disc in the transmitter. When first demonstrated, the Bell system did this with a separate synchronizinz circuit. Over land telephone lines, this consisted of a special pair of wires connecting Washington and New York, separate from the two lines used for carrying the actual image and the spoken words. With the radio television, a special signal was sent out over its own wave-length for the purpose.

Only two telephone lines, instead of three, or only two wave-lengths, are now required, as the result of the work of W. A. Marrison and J. W. Horton, in making quartz crystal oscillators capable of holding the rate of vibration constant to within one part in ten million.

The control of the picture on the television screen is now as simple as that of a motion-picture image on the movie screen. Sometimes the motion-picture image becomes "out of frame" when the pictures on the film are out of step with the mechanism. The effect is that the top of the picture is seen at the bottom of the screen, and the bottom at the top. At the touch of a lever by the operator this can instantly be corrected.

With the television apparatus, the failure of the two discs to keep in step produces a similar effect, except that the picture is displaced laterally, instead of vertically. The remedy is also very simple. Connected with the receiver are two buttons. When one is pushed, the whole picture slowly moves to the right, while the other moves it to the left. The operator merely touches one of the buttons until the picture is in the proper position, then the quartz oscillator holds it in place for a long time. In an hour, it is stated, the image will not wander more than one third of its width.

Despite this great simplification, which represents a step well in advance of anything yet accomplished in television, the engineers point out that it is still full of such complexities that its field of application is still quite restricted.

THE CONTROL OF ERYSIPELAS

ERYSIPELAS may now be added to the list of diseases controlled by man, Dr. Konrad E. Birkhaug, of the University of Rochester School of Medicine, told the American College of Physicians meeting at New Orleans.

As a result of four years of work, Dr. Birkhaug has developed an antitoxin treatment for use in the early stages of erysipelas that gives results commensurate with those obtained through the use of diphtheria antitoxin in the early hours of that disease.

The erysipelas treatment reduces to half the time that the patient must spend in the hospital. The mortality in adults has been reduced from twelve to only four per cent., while recurrent attacks of erysipelas have been

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prevented through a course of immunization through the use of toxin.

Dr. Birkhaug observed in 1924 that nine tenths of the streptococci associated with the disease were of a specific type. This form of organism had been suspected of causing erysipelas when it was discovered in the lesions of the disease in 1881. The production of the disease experimentally in animals and their protection with a specific antiserum confirmed Dr. Birkhaug's idea that the particular kind of streptococci observed was the cause of the disease. The next year he discovered the toxin produced by the streptococci and then in 1926 erysipelas antitoxin was produced. The evidence for erysipelas specificity has been confirmed by other laboratories since Dr. Birkhaug's pioneer work.

PREHISTORIC MAN IN CHINA

THE discovery of further traces of prehistoric men in China and the recent finding of teeth which belonged to ancient human beings like the Neanderthal men of Europe, has attracted geologists to intensive study of the prehistoric Chinese scene.

The evolution of the land surface on which early man dwelt in North China has been studied by Professor George Barbour, of Yenching University, Peking, and reported to the New York Academy of Sciences.

In the era before man appeared, the land had been worn down almost level and the rivers flowed smoothly over flat country, Professor Barbour's survey showed. Then this flat land was suddenly broken up by the same disturbance that pushed up the Alps, the Rockies and the Himalayas. The rivers had barely succeeded in opening out the valleys when a slight buckling of the surface dammed the streams back into lakes. About this time we find the first traces of primitive man, or some close relative of his, living in a limestone cave overlooking the Peking plain.

With a change of climate the rivers flowed more swiftly and cut narrow gorges, making the surface of China more rugged. As the soil was worn away, gentle upheavals in the earth's crust pushed the surface of Mongolia up, and cold dry winds blew over these high altitudes, picking up the dust and sweeping it along in immense quantities. The blanket of dust in some regions became as deep as 800 feet, and forms the famous loess of China.

In the limestone caves have been found stone axes and arrows belonging to the prehistoric men, and with the weapons are the bones of mammoths, deer, rhinoceroses and other animals and the broken eggshells of ostriches. The teeth found near Peking, and considered as possibly belonging to the oldest human inhabitants of China, were from one of these ancient cave shelters.

A communication from China, just received by Professor Barbour, states that new specimens of human fossil teeth have been found and are designated as belonging to the Neanderthal period, which in Europe was about 50,000 years ago.

ITEMS

GREATER deadliness to insects and their kindred pests, but less danger to human beings and warm-blooded animals, are the virtues claimed for two new types of spr chemicals by Dr. Simon Marcovitch, of the Tennes Agricultural Experiment Station. The new insect poiso on which he conducted his research are sodium fluori and sodium fluosilicate. He tried them on grasshoppe mosquito "wigglers" and one or two other small cre tures, and also on rabbits as substitutes for human su jects. He found that the insect life in general succumb to smaller doses of the new compounds, but that to t rabbits they were only about one ninth as poisonous as th standard arsenical spray materials now most widely use

A NEW type of dark glasses for outdoor wear at te nis, golf and other sports, and said to be especially usef for auto drivers at night when meeting cars with glarin headlights, has been produced in the optical works of th Zeiss firm at Jena. The basis for the new eye protectio consists of two wedge-shaped pieces of glass fused to gether. The upper member of the pair is made of a dar gray-brown glass, while the lower part is clear and u colored. Goggles made from this material are thus ver dark at the top, shading off gradually into clear glass a the lower edge. This arrangement cuts off the glare o the sky, while permitting an unclouded view of th ground. Motorists, encountering glaring headlight simply duck their heads a little and look through the top of their goggles until the offending car has passed, whe they again make use of their normal vision through th lower parts of the glasses.

GERMAN lovers of birds are up in arms over an attac being made by fisheries interests on the heron, a beauti ful bird given careful legal protection in America and other countries. The herons of the Moehne Valley, in Westphalia, have been accused of destroying undue num bers of fish, and a bounty of nine marks per head ha been placed on them. The defenders of the herons de clare that it has been possible to protect the Rhine fisheries without exterminating the herons there, and clai that there is no need to kill off the birds. Even the despised crow has its defenders in Germany. A large number of the black marauders have been killed lately by means of poisoned eggs. Friends of the crow decry this practice, claiming that in spite of its undoubted mischievous and thievish habits, it still has its counter balancing usefulness as a destroyer of field mice and similar vermin.

A HUNDRED skeletons and 2,500 records of the size and other physical characteristics of living modern Maya Indians of Yucatan brought back to Peabody Museum by Dr. and Mrs. G. D. Williams may give an insight into the kind of people who erected great cities and developed a culture in America long before the coming of Columbus. During an anthropometric survey of the Mexican state of Yucatan, Dr. Williams obtained information on 2,000 adults and 500 children of the descendants of the ancient Maya and also secured for scientific study the skeletons of a hundred present-day Mayas. Metabolic tests were included in the studies. The expedition that was in the field for eight months was under the auspices of the Bureau of International Research of Harvard University and Radcliffe College.